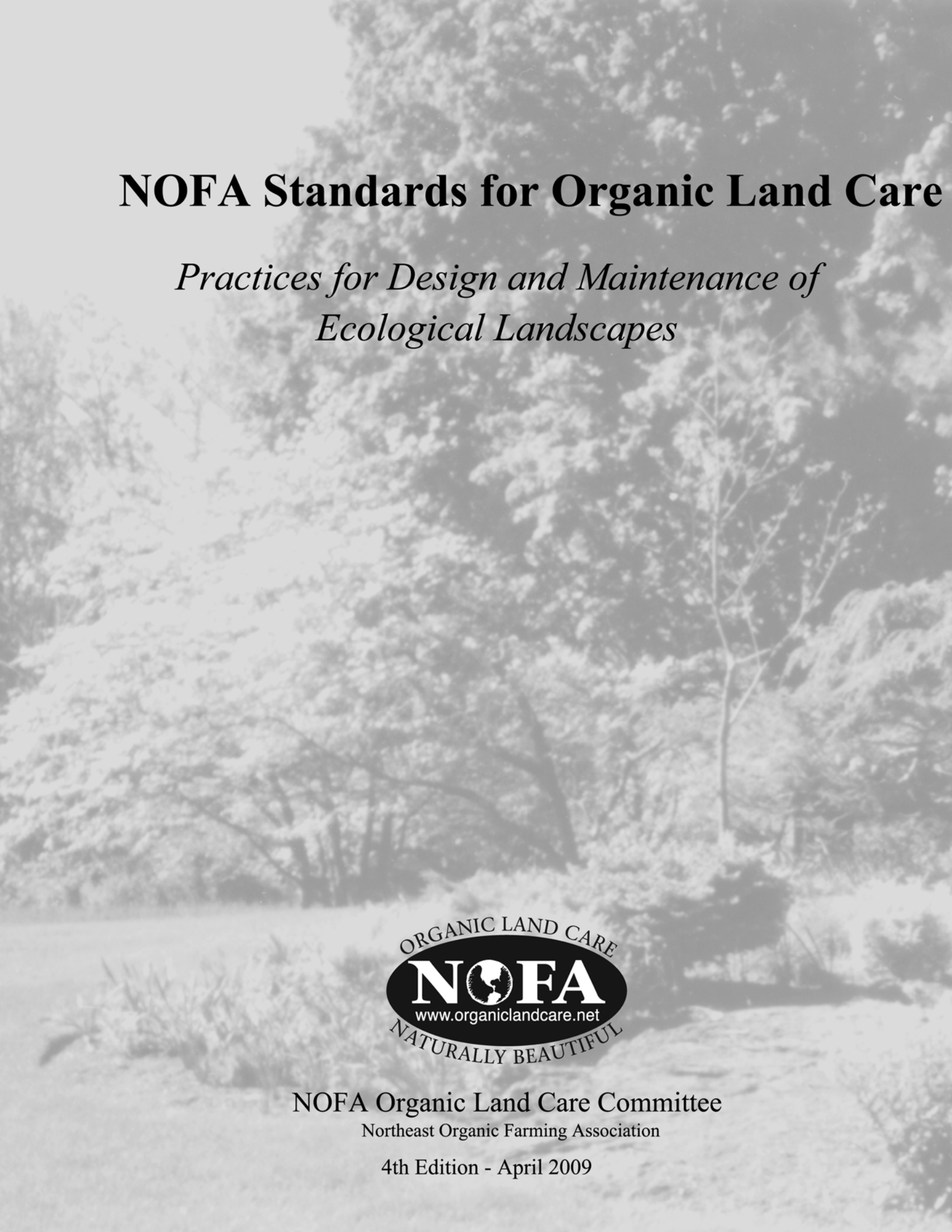
NOFA Standards for Organic Land Care

Practices for Design and Maintenance of Ecological Landscapes



NOFA Organic Land Care Committee
Northeast Organic Farming Association

4th Edition - April 2009

NOFA Standards for Organic Land Care
Practices for Design and Maintenance of Ecological Landscapes

BY THE NORTHEAST ORGANIC FARMING ASSOCIATION (NOFA)
ORGANIC LAND CARE PROGRAM

SARAH LITTLE, PH.D., CHAIR

4th Edition Contributors (listed alphabetically):

TIM ABBEY, Penn State University, State College PA
DONALD BISHOP, Gardens Are..., Marlborough MA
DWIGHT BROOKS, Dwight Brooks Horticulturalist, Katonah NY
CHRISTIAN G. CURLESS, Watertown CT
DR. SHARON DOUGLAS, Connecticut Agricultural Experiment Station, New Haven CT
BILL DUESING, CT NOFA, Oxford CT
DONNA ELLIS, University of Connecticut, Storrs CT
TODD HARRINGTON, Harrington's Safelawns, Bloomfield CT
ROSE HISKES, Connecticut Agricultural Experiment Station, New Haven CT
DON FRANCZYK, Baystate Organic Certifiers, Winchendon MA
ASHLEY KREMSER, NOFA Organic Land Care Program, Oxford CT
KATHY LITCHFIELD, NOFA/Mass, Petersham MA
MARISSA LUPIA, Environmental Advocacy and Organizing Program, Keene NH
DR. LESLIE MEHRHOFF, University of Connecticut, Storrs CT
MICHAEL NADEAU, Plantscapes, Inc., Fairfield CT
DINA PELLETIER, MPH, Edible Organic Design, Avon CT
ROBERT J. RAFKA, PH.D, URI Master Gardener, Stonington, CT
BRAD ROBINSON, Connecticut Department of Environmental Protection, Hartford CT
BARBARA SCHLEIN, Fountain Gardening Services, Woodbridge, CT
KIMBERLY STONER, Connecticut Agricultural Experiment Station, New Haven CT
MARY TYRRELL, Yale School of Forestry & Environmental Studies, New Haven CT
CAMILLA WORDEN, Camilla Worden Garden Design, LLC, Danbury, CT
PRISCILLA WILLIAMS, Pumpkin Brook Organic Gardening, Inc., Townsend MA

Acknowledgements

The first edition of the *Standards* was prepared for publication and published with assistance from the New England Grassroots Environmental Fund. We are very grateful for their support. We are also grateful for the support of The Antioch University New England Advocacy Clinic and Marissa Lupia for her hard work, research, and contributions to this fourth edition.

The Committee wishes to thank the following people for their technical input and review of the early drafts of the *Standards*: Nancy DuBrule, Natureworks; Karl Guillard, University of Connecticut; Kathy Johnson, USDA Natural Resources Conservation Service; Tom Morris, University of Connecticut; Julie Rawson, NOFA/Mass; Peter Rothenberg, CT NOFA; and Nancy Stoner, Clean Water Program, Natural Resources Defense Council.

NOFA Standards for Organic Land Care.....*1*

Principles of Organic Land Care

The mission of the Organic Land Care Program is to extend the vision and principles of organic agriculture to the care of the landscapes where most people carry out their daily lives. We do this by educating land care professionals and the general public about the virtues of organic land care and about practices which maintain soil health, eliminate synthetic pesticide and synthetic fertilizer use, increase landscape diversity and improve the health and well-being of the people and web of life in our care.

The Organic Land Care Program, formed in 1999, has developed these standards as part of the process of educating land care professionals about the meaning of the word "organic" and to present our vision of how these principles can be applied to the landscaping profession. Through an education and accreditation program, we hope to make available to the public landscaping services that will meet or exceed the standards presented here. We also hope to educate the public about the meaning of "organic" and the benefits of this option for care of the land around their own homes, neighborhoods, and communities.

Basic Principles of Organic Land Care

Adapted from the "Principles of Organic Agriculture," International Federation of Organic Agriculture Movements (IFOAM)

1. **Principle of health**. Organic Land Care should sustain and enhance the health of soil, plant, animal, human, and planet as one and indivisible.
2. **Principle of ecology**. Organic Land Care should be based on living ecological systems and cycles, work with them, emulate them, and help sustain them.
3. **Principle of fairness**. Organic Land Care should build on relationships that ensure fairness with regard to the common environment and life opportunities. Fairness is characterized by equity, respect, justice, and stewardship of the shared world, both among people and in their relationships to other living beings.
4. **Principle of care**. Organic Land Care should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

Health

Health is not simply the absence of illness, but the maintenance of physical, mental, social, and ecological well-being. Our role is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings, and with the future of the planet in mind. We seek to maintain and increase the long-term health of soils, and the diversity, resilience and sustainability of ecosystems. We strive to avoid all forms of pollution in the establishment and care of landscapes.

Right Plant, Right Place

Plant health depends on growing the plant in the right place and in healthy soil appropriate to the habitat and needs of the plant. Plants have evolved to occur in certain niches in the landscape. Choosing plants suited to a specific site, rather than modifying a site for the plants, is the embodiment of "Right Plant, Right Place."

Ecology

We seek to work with natural systems rather than trying to dominate them, and to encourage and enhance biological cycles involving microorganisms, soil flora and fauna, plants, and animals. These cycles are universal, but their operation is site-specific. We work as much as possible within a closed system with regard to organic matter and nutrient elements, and, when inputs are needed, to use renewable resources from local sources. We must protect the diversity of the land and its surroundings, including protection of native plant and wildlife habitats.

Organic Land Care depends upon the principles of ecology and sustainability for long-term health of plants and soils. Ecology describes the relationships among living things and their surroundings. Sustainability relates to the ability of living things to survive. When plants are carefully chosen for a site and planted and maintained according to these principles, they will thrive for the long term.

Fairness

An integral part of organic land care is stewardship of the earth's inhabitants, including humankind. To be an organic land care employer entails a strong belief in this ethic, including fair distribution of assets and benefits, development of business systems that respect the requirements of nature, family needs, personal values and goals, and sustainability. To be considered sustainable, our businesses must be economically sound, socially acceptable, and environmentally benign. Each company should set a required amount of hours to be worked. Any work beyond this should be voluntary, and the employee paid for the time in accordance with all applicable laws.

We offer this as a philosophical statement, rather than a mandate. Business owners must be free to define honest and ethical social conduct within their own personal beliefs and conditions. In any case, all federal, state, and local laws must be complied with.

Employees

Employees involved in organic land care must receive compensation which meets their basic needs and allows fair return and satisfaction from their work. Included in this compensation is a safe, respectful, working environment that ensures their basic dignity. Employees are entitled to at least one day of rest out of every seven. Employees are to be informed in a timely and thorough manner of their legal rights and the policies of the company. Employees must be informed of any hazards in the workplace (e.g., toxic materials, dangerous equipment), be properly trained, provided all necessary personal safety equipment and be instructed in its use, and be well protected from such hazards. Employees are to be allowed sufficient and adequate breaks for rest, intake of food and water, and use of sanitary facilities.

Employers

Employers are entitled to an honest day's work from their employees, adherence to all agreed-upon company policies, as well as reasonable care of company property and respect for clients and vendors. Employers are encouraged to go beyond the minimal employer-employee relationship by increasing participation and responsibility of employees in the business, with wages and benefits commensurate with such increased responsibility. Employers are entitled to fair and equitable treatment and pricing from vendors, as well as acceptable terms of payment, and to be treated with respect and compensated in a timely manner by their clients.

Clients

Clients of the company are entitled to honest and ethical business practices, a fair price for materials and services provided, and a job performed to their fair, reasonable satisfaction.

Vendors

Vendors of the company are entitled to honest and ethical business practices and to compensation within the terms agreed upon with the company.

Care

We must consider the wider social and ecological impacts of the materials and techniques used and the landscapes created.

Do No Harm

Every land use decision we make will have a positive or negative effect on the land in our care. One of the tenets of organic land care is to protect and enhance the natural elements that exist on a site—to do no harm. Elements that benefit the whole ecosystem—such as indigenous plants and soils, wildlife corridors and habitat, riparian buffers and watershed drainage, and their interaction with each other and their surroundings—should be carefully considered before any site "improvements" are made. If these natural elements are damaged or nonexistent, then restoration or establishment should be the aim. This can be best done by studying natural areas or remnant woods with similar landforms that are close by and using this ecology as a model for restoration.

Genetically Engineered Organisms

In recent years, the organic community has had to address the use of genetically engineered organisms and their products in light of the principles and goals listed above. The National Organic Standards of the United States Department of Agriculture contain the category "excluded methods" for organic growing, and they describe and define "excluded methods" as: "A variety of methods used to genetically modify organisms or influence their growth and development by means that are not possible under natural conditions or processes and are not considered compatible with organic production. Such methods include cell fusion, microencapsulation and macroencapsulation, and recombinant DNA technology (including gene deletion, gene doubling, introducing a foreign gene, and changing the position of genes when achieved by recombinant DNA technology). Such methods do not include the use of traditional breeding, conjugation, fermentation, hybridization, in-vitro fertilization, or tissue culture."

The *Standards* and the NOFA Accreditation Program

Purpose of Standards

The purpose of the *Standards* is to:

- Present the fundamentals of organic land care and currently accepted practices and materials
- Specify the requirements for accreditation for organic land care
- Specify practices that accredited land care professionals will pledge to abide by in providing organic land care services

The intent of the *Standards* is not to provide all the information needed for successful organic land care. More detailed information on organic land care is provided in the NOFA Accreditation Course in Organic Land Care, currently offered annually in Connecticut, Massachusetts, and Rhode Island.

Definition of Terms in the Standards

Preferred

These are the practices and materials the NOFA Organic Land Care Committee finds to be ecologically appropriate and in accord with the goals of organic land care.

Allowed

These are practices and materials that are acceptable when needed, but should be reduced in favor of the preferred alternatives, where possible.

Prohibited

These materials and practices are not acceptable in organic land care.

Emergency Non-Organic Rescue Treatment

There may be rare occasions when the organic land care professional and the client, who have previously agreed on organic land care, will decide to use extraordinary measures that are prohibited under the *Standards*.

An example might be to save the life of a tree of great value from a pest that cannot be adequately controlled using organic methods. In this case, the professional should inform the client prior to any emergency non-organic rescue treatment about the need for this treatment. Emergency non-organic rescue treatments should be rare and only undertaken as a last resort and should be approved by the client.

Standards Review and Revision Procedures

The *Standards for Organic Land Care* were researched and written in 2000-2001 by a group of practicing land care professionals, scientists and concerned citizens, with assistance from technical advisors. The *Standards*—and especially the preferred/allowed/prohibited practices and materials—are intended to be reviewed periodically by practitioners and the NOFA Organic Land Care Committee and amended as appropriate. The current revision is the fourth revision of the *Standards.*

Suggestions for changes to these *Standards* are welcome. Land care professionals, scientists, extension educators, government officials and others are invited to submit suggestions in writing to the Organic Land Care Committee. New materials, new products on the market and new information on practices

will be considered at the time of *Standards* revision.

OLC Standards and the National Organic Program (NOP)

The *Standards* came originally from the CT and Mass NOFA agricultural standards, and were developed before the NOP was in effect. On some issues the *Standards* have been modified to come closer to the NOP (notably composting manures), but on other issues we have chosen to differ. In some ways we are more lenient, and in some ways we are stricter.

Some specific differences:

- CT NOFA agricultural standards did not allow use of Chilean nitrate fertilizer, and we kept this prohibition in the *Standards*. The NOP allows use of Chilean nitrate up to a certain percentage of the nitrogen applied.
- Inerts in pesticides: The NOP allows only inert ingredients from EPA Lists 4A and 4B. A significant problem—and this is also a problem for agricultural certifiers— is that inert ingredients are proprietary information. So, they are not on the label, and the manufacturers of the products are not required to divulge this information. In some cases, manufacturers decide they want to put their products on the OMRI list, so they reveal their proprietary information to OMRI and pay OMRI to review this information and put them on the list if appropriate. Also, manufacturers sometimes choose to reformulate pesticides to meet the NOP standards and be listed by OMRI (Entrust®, a spinosad product formulated for the NOP and listed by OMRI, is an example). This is expensive, and they don't generally do this for products labeled for landscape use (such as Conserve®, a spinosad product not listed by OMRI). Therefore, for practical reasons, the *Standards* currently prohibit EPA List 1 Inerts (Inert Ingredients of Toxological Concern), which would be required to be on the label.
- Emergency Non-Organic Rescue Treatment: There is no such provision in the NOP.

Accreditation by NOFA to Provide Organic Land Care

The NOFA Organic Land Care Program employs an Accreditation Manager who is free from conflicts of interest with the land care professionals. Accreditation will be granted to an individual professional upon completion of the designated course, successful completion of the course examination, and a signed agreement to provide land care according to the *Standards* for all clients requesting organic land care.

Accreditation will be for a period of one year and is renewable annually. Annual re-accreditation will be granted based on continued demonstration of competence in organic land care management and participation in educational programs reviewed and approved for credit by the Organic Land Care Committee.

Accreditation Requirements

The Organic Land Care Committee, overseen by the Boards of Directors of Connecticut and Massachusetts NOFA, determines the qualifications and rules for enrollment as an Accredited Organic Land Care Professional. Those who meet the following criteria are eligible to apply for NOFA Organic Land Care Accreditation:

- Completed Application Form and Accreditation Fee
- Completion of the NOFA Course in Organic Land Care
- Demonstration of knowledge of and skills in organic land care by satisfactory completion with a passing grade of the Accreditation Examination
- Signed pledge of agreement to follow the tenets set out in the *Standards for Organic Land Care* for all clients requesting organic land care

Accreditation is a privilege granted by the NOFA Organic Land Care Program. If the Accreditation Manager determines that any land care professional has misled clients about organic practices or failed to adhere to the *Standards* in providing services to clients requesting organic land care, the privilege may be withdrawn.

Public Information

The Accreditation Manager will provide a list of Accredited Organic Land Care Professionals to the public (currently published in the *NOFA Guide to Organic Land Care*) and also post it on the NOFA Organic Land Care website. The purpose of this list is to identify trained and qualified professionals, to foster and maintain professional competency, and to protect the public interest in the area of responsible use of land care products and land resources. Although persons on this list of Accredited Land Care Professionals meet specific requirements, NOFA is not responsible for quality or costs involved in work performance.

Accredited Organic Land Care Professionals are allowed to use a NOFA-approved logo on their printed marketing materials for the year in which they are accredited. For example, the logo might appear on business cards, brochures, yellow pages and newspaper advertisements, uniforms and vehicle signage.

The NOFA Organic Land Care Program has several methods of outreach to publicize the program and promote the Accredited Organic Land Care Professionals. We publish educational materials for homeowners and other clients available for the Accredited Organic Land Care Professionals to distribute.

Split Businesses

In cases where the same business offers organic and non-organic land care options it is crucial that clients understand clearly whether they are receiving organic or conventional land care services. Printed

business materials and advertising that are directed to the public must clearly distinguish the different arms of the business. **The NOFA logo must not be displayed on vehicles providing non-organic treatments.**

Any application equipment used for organic treatments must not also be used for non-organic treatments. Any materials used in organic land care practices must be stored with adequate separation from non-organic materials to prevent cross-contamination.

Site Analysis, Design and Management

Site Analysis, using the principles of these Standards as a guideline, is the observation of the key elements of a site, and an understanding of how these elements affect the relationship between organisms (people, plants, animals, soils) and the site. Site Analysis is the primary discipline used to determine appropriate land use - including plant selection and placement, construction and placement of hardscape elements on the site, and in some cases, site modification to create certain ecosystems.

Design is the creative application of these principles on the landscape. It employs the disciplines of ecology and sustainability to create landscapes that can be managed organically.

Management refers to the holistic care of landscapes before, during and after installation. It utilizes recognized organic methods and materials, as well as innovation and experimentation within the guidelines of these Standards. One of the goals of organic management is the gradual decrease of inputs as the landscape grows toward sustainability.

Preferred

- Site analysis that includes: special attention to variation in microclimates; evaluation of sunlight availability and degrees of shade; soil analysis (see Soil Testing); wind patterns and air circulation; temperature; conditions of existing plants; and moisture characteristics of the site
- Selecting and placing plants whose characteristics are appropriate to the site
- Leaving established ecosystems intact (except where invasive or harmful plants exist—see Invasive Plants section)
- Selecting and using native plants correctly
- Producing food (vegetable gardens, edible landscapes)
- Creating, restoring, protecting, and enhancing wildlife habitat (e.g. riparian buffers)
- Establishing buffers to protect organic sites from neighboring non-organic sites
- Designing landscapes that are designed to enhance the principles of ecology and sustainability (e.g. lawn reduction)

Allowed

- Modifying existing habitats within the guidelines of these Standards where new landscape design is desired

Prohibited

- Breaking local, state or federal laws regarding wetlands and buffer zones
- Using plants inappropriate to the site, or that require extraordinary inputs and efforts to keep them alive
- Modifying a site in a way that results in considerable harm to the environment

Air

Overview

By increasing plant biomass and soil organic matter, more carbon is stored on-site, which reduces greenhouse gas effects on the earth's atmosphere**.** The production and use of synthetic fertilizer, particularly nitrogen, significantly contributes to greenhouse gases. This is an important reason to use natural materials as fertilizers.

Proper choice and placement of plants may improve quality of life and reduce impact on the environment, including such conditions as dust, pollutant drift, snow drift, temperature modification, air flow and visual impacts.

Air is an essential component of soil and is a requirement for healthy root growth. A typical landscape soil contains 5% humus, 45% mineral, 25% air, and 25% water. This soil is easy to grow plants in, holds moisture, minimizes erosion and provides air to aerobic microorganisms and roots of plants. There are other soil types that contain more or less air that are perfectly natural and should be left in their natural state.

Preferred

- Create buffers (or put up fencing) to protect the property from spray, drift, dust and other airborne pollutants
- Utilize aerobic compost properly on site (to minimize air pollution from transporting materials to and from the site)
- Choose and place plants to moderate temperature and influence airflow
- Use methods that maintain adequate soil organic matter and natural soil porosity, and reduce soil compaction

Allowed

- Mechanical aeration and breakdown of cores
- Application of organic matter or sand
- Soil cultivation
- Irrigation (only when necessary)
- Limited use of leaf blowers and other power equipment that cause air and noise pollution
- Appropriate use of heavy equipment
- Approved soil amendments properly applied
- Organic soil flocculent

Prohibited

- Over-application of soil amendments that may cause soil compaction and/or air pollution
- Over-watering that may block or reduce aeration of the soil
- Excessive mechanical aeration or rototilling and resultant oxidation of organic matter and soil compaction
- Any non-approved soil amendments

Water

Overview

Water is an essential, non-renewable component of the environment and moves through the environment continuously in a process known as the water cycle. Under natural conditions, some rainwater soaks into the soil and is then taken up by plants or moves deeper into the groundwater system and some flows overland as runoff. Adding impervious surfaces increases water runoff and decreases infiltration. When the land surface is changed-- through soil compaction, loss of vegetative cover or building of structures and paving of roads and parking areas--impermeable surfaces increase. Rainwater can no longer soak into the ground and instead runs over the surface to the nearest down-slope water body, creating flooding problems.

Water conservation and protection of water quality should be factored into site design and management practices. Existing natural water features (wetlands, streams, ponds) on and near the property should be identified and protected. Where appropriate, excessive rainwater runoff should be minimized by promoting infiltration with rain gardens or other rainwater collection techniques. Soil texture (sand/silt/clay) as it affects water-holding capacity and depth to groundwater (which fluctuates seasonally based on rainfall and plant uptake) are important factors in plant selection.

Preferred

- Right plant, right place—choose plants suited to site conditions
- Minimize impermeable areas (driveways, terraces, etc.)
- Minimize lawn areas (to reduce irrigation needs)
- Direct runoff to natural depressions or infiltration areas
- Create/maintain natural buffers along watercourses and wetlands
- Rainwater collection properly maintained to prevent mosquito breeding and contamination
- Provide appropriate water sources for wildlife
- Rain gardens
- Use mulches and plants to retain moisture
- Choose plants that minimize the need for irrigation, pest and disease control
- Maintain existing soil structure

Allowed

- Irrigation only when necessary based on soil type and plant needs
- Retention basins designed by a professional engineer that meet all applicable laws
- Drainage of non-wetland areas where regulations permit, providing the outflow causes no damage to the surrounding environment
- Use of gray water for irrigation of non-edible plants
- Improve soil structure to reduce compaction and erosion

Prohibited

- Excessive irrigation that may cause water run-off, puddles, compaction, disease or growth of slime mold in lawns
- Inappropriate plant choice—avoid plants that are not suited to site conditions
- Surface water causing flooding or erosion problems
- Leaching of nutrients and/or soil amendments through runoff
- Drainage or filling of wetland areas

Soil Health

Overview

A basic principle of any organic land care practice is knowledge of and proper care for the soil. Organic land care emphasizes a holistic approach to plant health by nourishing the soil life instead of feeding the plant directly. This results in healthy soil, which produces healthy plants. The relationship between a given soil and a plant can be looked at in two ways:

1) the need to alter the soil can be minimized by choosing appropriate plants for that soil type; and
2) the soil can be amended to provide for the long-term health of the plant.

In either case, soil testing is important in order to understand the characteristics of the soil and the balance of soil elements (see Soil Testing). Soil tests along with site analysis allow the land care professional to select and implement practices that maintain or improve the soil's life and vitality and minimize soil erosion. A healthy soil is free of crusts, compaction, pesticides and other toxins, salt buildup, and excessive erosion. In a healthy soil, the native organisms are active because organic matter is sufficient and nutrients are balanced.

The soil food web is the community of organisms living in the soil. A healthy soil food web forms protective layers around roots to prevent pathogens from attacking the roots; helps plants obtain nutrients from the soil; breaks down toxic compounds that inhibit plant growth; improves disease suppression; and builds soil structure so that nutrients and water are easy for the plant to obtain, and easy for roots to move through. For more information about the soil food web, see the Soil Foodweb web site www.soilfoodweb.com.

In natural systems, organic matter generally cycles in place, added to the soil through root and stem decay of winter-killed annuals and leaf decay. A thriving microbial community digests and breaks down this organic matter to release nutrients back to the soil. The organically maintained landscape retains and recycles organic matter, to the extent that the client's needs and the situation will permit. On-site composting is a means to this end, as is direct mulching. By closing the nutrient cycle in this way, the need for external inputs is minimized.

Organic soil amendments may be needed to help balance a soil's chemistry, stimulate its biology, and restore its physical composition. Such amendments may also be needed to feed turfgrass in a lawn, which has extraordinary nutrient needs because it is grown in an unnatural way—perpetually mowed and kept green as long as possible.

Organic soil fertility is based on feeding the soil, not just the plant. This means that carbon is fed to the soil along with nitrogen through the use of manure, compost, blended organic fertilizers, and, in some situations, cover crops. Horticultural methods which short-cut this natural order by directly feeding plants synthetic nitrogen-phosphorus-potassium (NPK) lead to damaged soil and a weak root systems, making the plants more susceptible to insects, disease, and drought. Over-fertilizing the plant (chemically or organically) may also inhibit the development of mycorrhizae—symbiotic fungi growing on or around plant roots that help to gather nutrients beyond the range of the roots themselves. Eventually the soil structure collapses and it becomes infertile. To revive dead, compacted soil, it may be necessary to apply compost to improve and build soil life.

A well-balanced soil-building program that increases humus content and organic matter gives many benefits. It recycles nutrients, improves water retention, balances minerals, and buffers pH. In addition to compost and manure, other amendments may be indicated based on the soil test results, such as root stimulants, rock dust, secondary micronutrients, flocculents, beneficial microbes, organic humus,

volcanic humic shale ore, fulvic acid, or kelp.

Most turf grasses and ornamentals perform best when certain cations are in balance, with the base saturation in these ranges: potassium 2-7%; calcium 65-85%; magnesium 10-20%; hydrogen 0-5%; sodium 0-5%. Micronutrient needs may differ according to the turf or ornamental plant type. It is important to get the pH in the right range (depending on whether the plants to be grown prefer acid or nearly neutral soil). According to one school of thought, it is important to balance the calcium-to-magnesium ratio. If magnesium is too high relative to calcium and liming is needed to adjust pH, use calcitic lime instead of dolomitic lime, which is high in magnesium.

Soil Testing

Overview

Healthy soil contains the proper balance of organisms, minerals, nutrients, organic matter, and other essential components—information that can be determined by soil testing. Soil sampling is used to determine depth, structure and texture of the topsoil layer and basic characteristics of the subsoil layer. A standard soil test is used to determine soil pH (acidity/alkalinity); the percent of organic matter contained in the soil; any nutrient or mineral deficiencies, excesses or imbalances; and recommendations for corrective measures. For these reasons soil testing is mandatory when amending the soil with nitrogen, phosphorus or potassium. A more comprehensive soil bioassay can evaluate the presence and balance of soil organisms such as fungi, bacteria, nematodes and protozoa.

A soil test will produce meaningful results only when a representative, aggregate sample is collected and properly prepared for each area of interest (the vegetable garden, the lawn, the perennial bed, around a tree, etc.). Obtain soil samples (generally to a depth of 4-6") using a clean plastic or stainless steel tool and collect multiple samples (1-2 per 100 ft^2). Mix them in a plastic or stainless container and remove all plant material and rocks using a sieve in the range of 2 mm (0.79"). Retain a portion (~1 oz.) of the aggregate sample; store at ambient temperature, out of direct sunlight, preferably in a porous container. Submit the soil for testing in a timely manner; an overly aged sample may no longer be representative.

Soil test kits sold in garden shops are frequently based on colorimetric reactions and their results are only as accurate as one's visual acuity. Homeowner-grade pH meters are also highly suspect in that their readout is analog and calibration against standard buffer solutions is not possible. Recently introduced *digital* pH meters such as the Hanna pHep5 are capable of two-point calibrations against standard buffer solutions. In the hands of a trained soil tester, their readings are both accurate and precise. Soil pH is measured by preparing a slurry of the sample in distilled or deionized water, swirling the suspension for a minute or more, then placing the meter in the liquefied soil sample until a stable reading is obtained.

Preferred

- Perform an initial soil test, then test every three years afterward, according to standard procedures
- Obtain separate soil samples from each type of microclimate (sun/shade, wet/dry, etc.) to ensure accurate representation of all soil conditions on the site
- Send samples to a professional or government soil testing lab for analysis and organic recommendations and soil bioassay if desired (see Appendix for a list of soil testing laboratories)
- Keep records for each site, including name and location, date of initial test, preexisting conditions and any observations, and a copy of the soil test results
- Site records should include all soil test results, a record of any applications and a summary of any changes observed

Allowed

- In cases where the soil test laboratory recommends non-organic amendments, adjust to meet the requirements of these Standards
- Application of amendments after planting, following soil test results
- Measurement of soil pH using a digital pH meter calibrated against standard buffer solutions. Individuals performing such tests should be trained in the appropriate collection of soil samples, calibration and use of the meter, as well as the standard testing protocol.

Prohibited

- Using a home soil test or kit to determine application of soil amendments
- Using tools and containers for soil testing that retain remnants of other matter that would taint the results
- Amending the soil with nitrogen, phosphorus or potassium without the guidance of proper soil test results
- Following soil test recommendations for amendments and practices that do not meet these Standards
- Using a colorimetric soil test kit or homeowner-grade (analog) pH meter to determine application of soil amendments.

Toxic Elemental Species in Soil

Overview

Many elemental species (metals, metalloids, and non-metals) occur naturally in soil as inorganic ions (charged species) and at least 18 are considered to be plant nutrients. Of these elements, approximately half are required by plants in very small quantities and are described as trace- or micro-nutrients. Human activity can adversely affect soil, either by the incorporation of toxic elements like mercury, lead, and cadmium or by increasing the proportion of necessary trace elements like copper or zinc to toxic levels. Modes of incorporation into soil can include the use of synthetic pesticides, pressure-treated wood, past use of lead-containing paint, application of industrial or domestic sludge (sewage sludge and biosolids), smokestack emissions, and past use of leaded fuels. An advanced soil test is strongly encouraged in potentially contaminated sites before growing food or creating play areas for children.

Toxic elements, once introduced to the soil, have a tendency to persist. *Preventing* the contamination of soils is critical because remediation of polluted soil can be both cost-prohibitive and time-consuming. The following management practices will not remove toxic elemental species, but will help to decrease their solubility, thereby reducing their bio-availability and the potential for adverse effects. Metallic elements such as mercury, cadmium, lead, nickel, copper, zinc, chromium, and manganese exist as positively charged species (cations). Molybdenum is also a metallic element, but is found in a negatively charged form (an anionic species) as are metalloids and non-metals like arsenic, selenium, and boron. Some elements, especially arsenic and chromium, exist in multiple forms or oxidation states. Chromium in the +3 form (Cr^{+3}) is a plant micro-nutrient. In its fully-oxidized form (Cr^{+6}), this element (especially at high levels) is associated with cancer and birth defects. Proper management of elemental contaminants begins with an advanced soil test. Once the results are known and fully understood, the proposed remediation plan must comply with all pertinent federal, state, and local statutes.

Preferred

- Raise soil pH to 6.5 or above (but no higher than 7.2) to reduce the solubility/bio-availability of cationic contaminants such as lead and cadmium (or when other cationic elements like copper, zinc, or manganese are present at excessive levels).
- Lower soil pH to reduce the solubility/bio-availability of anionic elemental species such as boron, molybdenum, and selenium when they are present at excessive levels.
- Where ecologically and legally feasible, drain wet soils to decrease the bio-availability of elemental contaminants (except Cr^{+6})
- Remediate soil contaminated with Cr^{+6} by increasing application of both organic matter and water (reduction to the less-toxic Cr^{+3} form occurs when soil oxygen levels are low).
- Apply an allowed form of phosphorous (see Fertilizers and Soil Amendments) to reduce the solubility of cationic contaminants- but note that the effect will be exactly the opposite on anionic contaminants [extreme care should be used when applying phosphorous because (in excess) it will cause water pollution].
- Limit soil disturbance to reduce human exposure at suspected or known to be contaminated sites (heavily-traveled roads, near gas stations, and industrial areas).
- Maintain a thick turf, dense evergreen groundcover, or impenetrable vegetation on contaminated sites to prevent children from digging and to reduce tracking of contaminated soil into buildings.
- Work in collaboration with a phytoremediation specialist to determine how to use specific plants to bio-accumulate and remove toxic elemental species from the contaminated site.

Allowed

- Disturbance of contaminated sites, provided no edible and/or berrying plants are installed, and there is no migration of contaminants to adjacent sites
- Cover contaminated soil with sod or with plastic and mulch, gravel, or stone
- When planting over the surface of a contaminated site, first seal the site with plastic mulch, then add an appropriate amount of compost or soil for the plant

Prohibited

- Installation of edible and/or berrying plants
- Removal of contaminated soils for other uses, except for regulated disposal
- Runoff from disturbed sites onto other areas

Materials in Contact with Soil or Plants

Overview

Materials that come in contact with soil or plants, such as building materials, masonry, edging materials, and landscape fabrics, should be free of harmful substances such as toxic metals, pesticides, or toxic chemicals. Pressure-treated wood products which contain chromated copper arsenate (CCA) are of special concern. These products are no longer sold, but if they have been used in the past, toxic residues may still be present. Studies have shown that high amounts of CCA, which is highly toxic, can be released from the wood in most soils of the northeast.

Preferred

- Untreated rot-resistant wood, such as cedar, white oak, or black locust from sustainably harvested sources
- Wood alternatives such as recycled plastic and plastic and wood fiber composites
- Masonry (stone, bricks, etc.)
- Non-galvanized or stainless steel

- If pressure treated wood is present, the soil should be tested for arsenic, chromium, and copper, before planting food crops or soil disturbance

Allowed

- If chemically treated wood already exists on a site and cannot be removed or client is unwilling to remove it, then wood can be coated with paints or stains formulated for such use, such as polyurethane, acrylic and spar varnish. Re-coat as required.
- Newspaper without glossy or color inks
- Plastic and nonwoven geotextile fabrics which do not contain polyvinyl chloride (PVC)
- Synthetic burlaps if removed completely at time of planting

Prohibited

- All types of chemically treated wood, burlap, stakes or twine
- Chemically treated paper and cellulose mulches
- Newspaper with glossy papers or color inks
- Plastic and nonwoven geotextile fabrics that contain polyvinyl chloride (PVC)
- Synthetic burlaps
- Creosote- or tar-treated wood (such as railroad ties)
- Petroleum-based wound dressings
- Galvanized steel

Fertilizers and Soil Amendments

Overview

Fertilizers and soil amendments are tools that enable us to modify existing soil conditions. The "feed the soil" principle is used to benefit plant health, not artificially stimulate plant growth. Unnecessary applications of any fertilizer or soil amendment can cause mineral nutrients to build up to excessive levels in the soil. At these levels, nutrients may enter local water resources. Nitrogen and phosphorus are the nutrients most involved in eutrophication of water bodies, and are thus of major concern as pollutants. Nitrogen can also be a health hazard when it pollutes drinking water supplies.

Many potential nutrients in soils are not readily available to plants. Proper management of soils can free these nutrients for uptake. The rate of release of mineral elements depends on environmental factors specific to each site. Therefore, the use of any amendment must reflect soil test results and good stewardship of the environment. It is preferred to use renewable materials that are sustainably produced. Many nutrient amendments are mined or harvested from natural sources that are not renewable. We do not want to waste these resources for our short-term benefit.

Preferred

- Compost in the amounts specified below
- Compost teas
- Cover crops and green manures
- Local or on-site nutrient sources

Allowed

- Blended organic fertilizers with ingredients that meet these Standards

Prohibited

- Exceeding the amounts of macronutrients recommended by a soil test
- Synthetically derived ingredients
- Blended fertilizers using a mixture of organic and synthetic materials, including transitional products
- Sewage sludge
- Allowing fertilizers to remain on sidewalks or pavement (typically after being applied by rotary spreaders). Fertilizers left on pavement go directly into the storm sewers and then into waterways. Any spillage should be swept or vacuumed up and reused.

Compost

Compost has many advantages over topsoil or mulch alone. Incorporating compost improves turf, shrub and shade tree performance in marginal or poor soils. Good quality compost improves soil structure, reduces runoff and compaction, enhances biodiversity, increases water and nutrient retention, increases microbial activity, supplies nutrients, helps suppress and prevent plant diseases, detoxifies certain pesticides, and inactivates and kills potential human pathogens. The benefits to the plants are: improved establishment of turf, ornamentals and shade trees; improved color; increased root growth; and reduced need for fertilizer, pesticides, and irrigation.

Compared with fertilizers, compost generally contains low and variable amounts of nutrients. A small amount of nitrogen (ammonium) is present in some compost. Other organic fertilizers may be required to meet plant nutrient requirements. Composting involves the decomposition and stabilization of raw, clean organic waste to an end-product of a humus-like material. High quality compost is organic material that has been well-decomposed, and is highly aerobic as a result of regular aeration. It is high in beneficial soil organisms such as actinobacteria, fungi, nitrogen-fixing bacteria, aerobic bacteria and many others.

A commonly accepted recipe for compost is to use 3 parts by volume brown material (carbonaceous, such as wood chips, sawdust, leaves, or shredded paper) and 1 part green material (nitrogenous, such as grass clippings, kitchen waste, green plant material, or manure).

Characteristics of well-decomposed or finished compost

Appearance: Few recognizable components of the initial raw materials. Color resembles dark topsoil, and compost has a light, crumbly structure. Finished compost does not release steam when disturbed.
Odor: An "earthy aroma" with no offensive odors such as ethanol, ammonia or sulfur.
Temperature: Not hot to the touch.
Weed seeds: No weeds growing in or around the pile. Proper composting at high temperatures destroys viable weed seeds.
Moisture content: Between 30-50%. Above 60%, compost tends to clump and not spread evenly, is heavy and difficult to handle, and can be anaerobic. Below 20%, it produces excessive dust, will tend to wash away and favors excessive growth of actinobacteria.
Carbon-to-nitrogen (C:N) ratio: Approximately 15:1, from raw materials with an initial C:N ratio of between 25:1 and 40:1. Above 30:1, soil microorganisms can immobilize nitrogen, making it unavailable to plants.
pH: Finished compost exhibits a pH between 6 and 7, normally around pH 6.8, a range which is favorable for most plants. Extremes in pH may result in reduced availability of some plant nutrients and/or toxicity problems.
Additional methods of evaluating compost quality: Laboratory testing and recommendations from other land care professionals. Commercial composters should have state certification or permit, as appropriate. A simple test to determine if compost is mature is to put 3 cups of compost in a sealed plastic bag and let it sit overnight at room temperature. If the bag expands, the compost is not finished. Another test is to use the compost to germinate watercress (*Nasturtium officinale)* seeds. If the seeds fail to germinate, or the seedlings are weak, spindly, or distorted, then the compost is not finished. (Note that watercress is listed as potentially invasive and should not be planted in the field.) Red clover (*Trifolium pratense*) is the best indicator of herbicide contamination. Garden cress (*Lepidium sativum*) is a good indicator plant for compost maturity.

Improperly composted organic matter that has gone anaerobic (or putrefied) may contain compounds toxic to plants and may have offensive odors from production of ethanol, ammonia or hydrogen sulfides. Check with your compost supplier for evidence of proper quality control to avoid this problem. Under specific conditions, anaerobic compost may be used to create proper growing media for wetland plants.

Caution: Herbicide Contamination of Compost

In the past, organic farmers and land care professionals have not had to be too concerned about herbicide residues in compost because most herbicides break down rapidly in the composting process. However, the persistent herbicides, clopyralid and picloram, which break down very slowly in composting, have been found to contaminate compost to the point where sensitive plants were damaged. As a result of these problems, the primary clopyralid product, "Confront", is no longer registered for use on residential lawns. However, it is still labeled for use on commercial lawns and golf courses. Herbicides containing clopyralid and the similar compound picloram also continue to be used agriculturally, including for cereals, hay and pasture. They pass quickly through grazing animals and pass into the urine, so compost made from feedstocks, including animal bedding and waste, may also be contaminated. See articles: www.mindfully.org/Pesticide/Clopyralid-Composting-Dow.htm and www.puyallup.wsu.edu/soilmgmt/Clopyralid.htm.

Be aware of these hazards, discuss them with your compost suppliers, and ask them if they have conducted bioassays on any potentially contaminated materials. For more information, see the magazine BioCycle. Review articles are posted on their website at: www.jgpress.com/BCArticles/2001/070132.html.

Analytical techniques associated with herbicide and pesticide residues continue to evolve as does our understanding of their degradation pathways. Once in the environment, herbicides are chemically and/or biologically transformed into new chemical entities that no longer kill weeds. However, these breakdown products should not automatically be considered biologically benign. 2,4-dichloro-phenoxyacetic acid (2,4-D) cleaves to produce 2,4-dichlorophenol as its initial degradation product; this halogenated aromatic compound is *significantly* more toxic than the parent herbicide. When in doubt about the inclusion of potentially contaminated organic raw materials into a mix for composting, consider not only the actual herbicide or pesticide, but also its known or proposed degradation products as well.

Preferred

- Compost yard waste properly on-site, and use the compost in beds or gardens. Locate compost piles where they will not be susceptible to runoff
- Monitor soil phosphorus levels with soil tests so that repeated compost application does not result in build up of excess phosphorus over time (see Phosphorus section)
- Use compost that is well decomposed
- Use compost from local sources using local materials to reduce transport of bulk materials
- **Soil incorporation prior to planting (one time application)**: Where soil improvement is needed, compost may be applied to the soil surface as a 1-2 inch layer (approximately 3-6 cubic yards per 1,000 sq. ft.), then incorporated into the soil to a depth of 4-6 inches. Make sure compost is thoroughly mixed with soil. A two-inch layer is better suited for very sandy or low-organic-matter soils. For more fertile soils, use less.
- **Top Dressing/Surface Application**
  - On turf: 1/4 inch or less, no more than two times per year for no more than three years unless a soil test shows organic matter less than 4% and phosphorus below "medium"
  - Around perennials: 2 inches or less
  - Around ornamentals and shade trees: 3 inches or less
- **Radial trenching or Vertical mulching:** For alleviation of compaction around woody plants, mix equal parts of compost and excavated soil to backfill trenches around the plant

Allowed

- Any compost which appears adequately decomposed, does not contain sewage sludge, industrial toxic wastes, large stones, trash or other prohibited materials, and is made from at least two different raw materials
- Sheet composting (surface application of organic material to compost in place) in establishing gardens and beds. Note restrictions below on sheet composting manure in beds where human food crops will be grown.
- Anaerobic compost only for growing wetland plants or restoring wetland soils

Prohibited

- Sewage sludge (biosolids), municipal solid waste, paper mill by-products as raw materials of compost. Current EPA standards are not adequate to protect the public from contamination of biosolids from toxic elemental species, industrial toxins, pharmaceuticals, and radioactive materials. These materials may be contaminated by toxic elemental species and other industrial toxins.
- Compost with excessive amounts of plastic, undesirable objects or offensive odors
- Compost with large amounts of weed seed
- Planting human food crops in sheet composting systems that use animal manure within 120 days before harvest (for other restrictions on use of animal manure, see the Manure section)
- Using more than the amounts specified
- Over-application of compost, which results in exceeding the limits for nitrogen and/or phosphorus (see sections under Fertilizers and Soil Amendments)
- Anaerobic compost as a soil amendment

Compost Tea

Compost tea is attracting increasing attention as an inoculant to enhance or restore soil and leaf surface microflora. There is research to show that compost tea has a role in deterring disease. However, under current laws, it cannot be claimed that compost tea suppresses or controls disease because it is not registered as a pesticide by the U.S. Environmental Protection Agency. Although compost tea is sometimes made by simply fermenting compost in water, it is now more commonly made in a brewer or extractor, which creates aerobic conditions to yield great quantities of bacteria, yeasts and fungi. In many cases a range of organic adjuvants including worm castings, kelp and/or fish hydrolysate are added as food sources; and yucca extract, saponin, rock dust, humic acid and/or fulvic acid are added as catalysts to create teas for specific uses. To maintain high quality, compost tea must be constantly aerated.

According to Soil Foodweb, Inc. perennials, annuals, and turf require a compost tea made from compost balanced between fungi and bacteria, or slightly higher in bacteria. This can be created with an initial mixture of 25% animal manure or worm castings (see Manure section for composting requirements), 50% green material (household waste, leaves and grass clippings), and 25% woody materials (wood chips, bark, sawdust and mushroom substrates). Shade trees and shrubs require a compost tea made from compost high in fungi. This can be created with an initial mixture of 50% green material, 45% woody materials resistant to rapid decay, and 5% manure or worm castings.

Compost tea can be used to adjust soil biology, in order to provide the proper soil environment for the plants we are trying to grow.

Caution: There are a lot of variables involved in creating high quality compost tea; therefore it is important to understand the process thoroughly before attempting to make or use compost tea.

Preferred

- Compost tea should be maintained in an aerobic state at all times.
- Constituent materials as allowed by these Standards
- Compost tea should be used within 6 hours of brewing. Extracted tea can be used for a longer period.
- The ratio of fungi to bacteria can be adjusted for its intended use
- Compost tea should have a level of *Escherichia coli* of less than 120 colony forming units per 100 milliliters
- Compost tea can be applied by soil drenching, root dip, or foliar application to improve lawn/plant health and vigor

Allowed

- General purpose compost tea, in which the biology has not been adjusted for a specific use

Prohibited

- Compost tea made with materials prohibited by these Standards

Manure

Overview

Manure is animal excrement that may be used as a nutrient amendment. A manure pile that has not been aerobically composted is considered raw manure. Raw manure is rarely used directly in land care, because it is difficult to handle and apply and is highly odiferous. However, manure is processed and mixed with other materials in blended fertilizers. Manure can contain human pathogens, pesticides, antibiotics, and growth hormones, therefore it must be completely composted before surface application. Manure may also contain prions and/or arsenic, which are not eliminated by composting. Manure from organic sources should not contain any of these substances. Any manure can contain high amounts of weed seeds, most of which can be killed by composting at high temperature. Unless incorporated, into the soil, the nitrogen in raw manure can volatilize and be lost into the atmosphere or be leached out by surface water and become a pollutant. Only well-composted manure should be used within 120 days of harvest on plants being grown for consumption, or not less than 90 days prior to the harvest of a plant whose edible portion does not have direct contact with the soil surface or soil particles.

Allowed

- Aerobically compost manure until it has the characteristics of finished, well-decomposed compost as defined above in order to minimize the risk of survival of human pathogens
- If an in-vessel or aerated static pile system is used, see the *National Organic Standards* for guidelines see: www.ams.usda.gov/nop
- Fresh manure, dehydrated manure, and manure slurry may be used only if soil-incorporated and applied more than 120 days before harvest of any crop for human consumption
- The amount of manure allowed per year should be determined by limits on nitrogen and phosphorus (see sections under “Fertilizers and Soil Amendments”)

Prohibited

- Application of raw manure in fall/winter without actively growing ground cover
- Raw manure applied on snow or frozen ground
- Raw manure applied on sandy, fast-draining soils in absence of ground cover
- Raw manure applied where human contact is probable, even if soil-incorporated

Nitrogen

Overview

Nitrogen is an essential macronutrient because it is required to create amino acids and proteins, genetic material, chlorophyll and other important biochemical molecules. Nitrogen is the most abundant gas in the atmosphere (78%) but the gaseous form (N_2) is inert and unavailable for use by animals and most plants. Turning N_2 into available nitrogen, or "fixing" it, requires breaking the bond between the nitrogen atoms, which requires energy. Under natural conditions nitrogen is fixed by lightning strikes through the atmosphere and by the work of a few species of symbiotic bacteria and some free-living bacteria and fungi in the soil or water. The amount of new, naturally "fixed" nitrogen being produced at any time is quite small compared to the amount already fixed and cycling through the ecosystem.

Human activities have almost doubled the amount of fixed nitrogen entering the cycle through the industrial production of fertilizer, selective cultivation of nitrogen-fixing plants and the burning of fossil fuels. Inorganic fertilizer is manufactured from N_2 using an extremely energy intensive process. See: www.epa.gov/watertrain/nitroabstr.html

These changes have affected the natural systems by increasing greenhouse gases in the atmosphere, depleting the ozone layer, increasing acid rain and smog conditions, creating eutrophic (over-productive) conditions in lakes and estuaries, and changing ecosystem balances by favoring N-tolerant plants over other species while creating deficiencies in other nutrients (calcium, potassium and magnesium). Nitrates in drinking water have also been linked to human health problems.

Plant and animal nitrogen sources also contain phosphorus, therefore their use should be limited by the requirements for phosphorus as determined by a soil test.

Preferred

- Alfalfa meal
- Composts
- Cover crops and green manures
- Lawn clippings
- Teas made from approved composts
- In lawns, minimize the need for nitrogen by leaving grass clippings, planting low-maintenance varieties, and including legumes in the lawn mix
- Feather meal and other low-phosphorus organic materials

Allowed

- Blood meal (take precautions to avoid direct human contact as blood meal may contain pathogens)
- Vegetable meal
- Fish hydrolyzate, emulsion or meal (caution, may contain mercury, PCBs or other contaminants). Be aware when choosing to use fish products that massive over-fishing is causing severe ecological damage in oceans.

- No more than 3 pounds of soluble nitrogen per 1,000 square feet per year
- No more than 1 pound of soluble nitrogen per 1,000 square feet per application
- Rates of nitrogen application must be further reduced after 2 years of organic management

Caution: the recommended application rate on some formulated fertilizer products will result in over-application of nitrogen. For example, if you use corn gluten as an herbicide, that counts as two applications of nitrogen at 1 pound per 1,000 square feet each. Only one additional application of nitrogen of 1 pound per 1,000 square feet is allowed per year. This is because the current manufacturers' recommended application rates for corn gluten as a pre-emergent herbicide exceed the allowable rates for a single application of nitrogen.

Prohibited

- Chilean nitrate, which has a high salt content, is water soluble and has a similar effect on soil as synthetic nitrogen. This is a place where the OLC *Standards* differ from the NOP (National Organic Program). Fertilizer approved under NOP by OMRI may contain Chilean nitrate
- Application of nitrogen fertilizer to lawns when grass is not growing actively enough to use it rapidly, generally between October 15 and April 1 in Connecticut and Massachusetts
- Allowing fertilizers containing nitrogen or phosphorus to remain on sidewalks or pavement (typically after being applied by rotary spreaders). Fertilizers left on pavement go directly into the storm sewers and then into waterways. Any spillage should be swept or vacuumed up and reused.
- Leather meal or its by-products
- Sewage sludge
- Synthetically-derived nitrates, urea, ammonia (e.g. ammonium sulfate)

Phosphorus

Overview

Phosphorus, in the form of phosphate, is an essential macronutrient—it is a vital part of the cellular energy transfer, or ATP system. Phosphorus is added to soils in natural systems by rock weathering. Leaching and runoff remove phosphorus from the soils, where it is carried to aquatic systems and gradually settles into deep water sediments in lakes and oceans. These large "sinks" of phosphorus can only be returned to the phosphorus cycle by upwelling of deep waters or geological uplift of marine sedimentary rocks. Because of the long geological time involved in cycling phosphorus out of "sinks," retaining phosphorus in terrestrial and aquatic ecosystem cycles is very important. Human activities have increased phosphorus inputs to the soil through the application of phosphorus-rich fertilizers, mined from rock phosphates and guano. Much of this phosphorus leaches (or washes) from the soil and into aquatic ecosystems. In fresh-water ponds and lakes, excess phosphorus can substantially increase plant productivity and lead to eutrophic conditions, causing increased phytoplankton and bacteria growth, loss of dissolved oxygen and loss of animal life in the system.

If a standard soil test gives a rating of medium or above for phosphorus, then no additional phosphorus should be applied. If other nutrients are needed, use organic fertilizers or composts that are low in phosphorus.

Preferred

- Compost
- Cover crops and green manures
- Compare with fertilizer and soil amendments preferred above
- Alfalfa meal

Allowed

- Rock phosphates
- Steamed or precipitated bone meal (take precautions to avoid direct human contact as bone meal may contain pathogens
- Greensand

Prohibited

- Mono-ammonium and di-ammonium phosphate
- Single and triple super phosphate
- Other synthetically-derived phosphates
- Applying more phosphorus than is needed based on soil testing

Potassium

Preferred

- Composts and compost teas
- Alfalfa meal

Allowed

- Greensand
- Seaweed
- Sulfate of potash (potassium sulfate)
- Sulfate of potash, magnesium (such as sul-po-mag)
- Rock or quarry dust
- Clean wood ashes [not to be co-mixed with ashes resulting from the combustion of painted or treated wood, wood composites, coal, household trash, or glossy (colored) paper]

Prohibited

- Muriate of potash (potassium chloride)
- Synthetically-derived potassium

Calcium

Allowed

- Aragonite
- Calcitic limestone (calcium carbonate)
- Agricultural gypsum (calcium sulfate)
- Kelp meal
- Dolomitic limestone

Prohibited

- Burned or quick lime (calcium oxide)
- Hydrated or slaked lime

- Synthetically-derived calcium

Sulfur

Allowed

- Sulfur (elemental)
- Epsom salt (magnesium sulfate)
- Agricultural gypsum (calcium sulfate)
- Sulfate of potash (potassium sulfate)
- Sulfate of potash, magnesium (such as Sul-po-mag®)

Prohibited

- Synthetically-derived sulfates
- Ironite® (contains high levels of lead and arsenic)

Magnesium

Allowed

- Dolomitic limestone (magnesium carbonate)
- Epsom salt (magnesium sulfate)
- Greensand
- Sulfate of potash, magnesium (such as Sul-po-mag®)

Prohibited

- Burned or quick lime (magnesium oxide)
- Synthetically-derived magnesium

Micronutrient Sources (Manganese, Zinc, Boron, Copper, Iron, Molybdenum, Chlorine)

Preferred

- Manage soils to release micronutrients already present
- Compost

Allowed

- Rock powders such as Azomite®
- Kelp
- Fish hydrolyzate, emulsion or meal (caution, may contain mercury, PCBs or other contaminants). Be aware when choosing to use fish products that massive over-fishing is causing severe ecological damage in oceans.

Prohibited

- Any synthetic source
- Copper sulfate
- Iron chloride
- Chelated iron
- Ironite®

Blended Fertilizers

Allowed

- Products containing only preferred and/or allowed mineral nutrients applied according to these *Standards*

Prohibited

- Products containing any prohibited materials, including "transitional" or "bridge" products

Liming Materials/pH Adjustments

Preferred

- Compost, compost teas, leaf mold (These *organic* materials will produce a pH moderating effect on soil, but only over time and multiple applications. *Inorganic* materials such as limestone or wood ashes will elevate pH much more rapidly.)
- Leaf mold

Allowed

- Agronite
- Calcitic limestone
- Dolomitic limestone
- Wood ash
- Granulated sulfur (decreases pH)

Prohibited

- Aluminum sulfate
- Synthetically-derived products
- Iron Sulfate
- Ironite®

Soil Conditioners

Preferred

- Composts and compost teas
- Cover crops and green manures
- Leaf mold
- Grass clippings

Allowed

- Humates and fulvic acids
- Greensand
- Gypsum
- Mulches
- Organic rock powders
- Sugar sources (molasses, glucose, sucrose)
- Peat moss (Although peat moss is widely used as a soil conditioner, we do not recommend it because the harvesting of peat moss destroys increasingly rare bog habitats.)

Prohibited

- Synthetically-derived products
- Anything containing sludge or biosolids

Microorganisms and Inoculants

Allowed

- Non-GMO (genetically modified organism) microbial inoculants
- Biodynamic preparations
- Compost teas
- Soil bio-stimulants (beware of false claims and synthetic ingredients)

Prohibited

- GMO (genetically modified organism) microbial inoculants

Soil Mixes

Preferred

- Compost- or soil-based potting mixes free of prohibited substances

Allowed

- Compost-free mixes without prohibited substances
- Yucca extracts used as wetting agents
- Addition of beneficial fungi and/or bacteria to the mix
- Peat moss

Note: Although peat moss is widely used in soil mixes, we do not recommend it because the harvesting of peat moss destroys increasingly rare bog habitats.

Prohibited

- Synthetically-derived products
- Synthetic rooting or wetting agents

Planting and Plant Care

Planting Bed Preparation

Overview

Planting beds are prepared differently when an organic approach is used. The well-being of the soil always comes first. The kinds of plants grown, the site conditions, and the desired outcome dictate the methods(s) of preparation. If a soil test indicates the need for amendments, they should be incorporated into the soil whenever possible. A soil bioassay may indicate what plants will do well with the existing soil biology or ways to adjust the soil biology to suit the desired plants.

Although many variations exist, there are two basic ways to prepare the soil in a planting bed. The first method is to not amend the native soil at all. This requires careful plant selections that match the soil types and site conditions. This approach requires the least inputs and is the least expensive, but requires the most knowledge. The second method is to amend the existing soil with compost or organically-approved minerals and nutrients. This approach may result in more lush growth, and may necessitate the need for additional inputs to maintain lushness. If amendments are to be used, it is better to amend the surrounding soil as well as the planting area in order to provide sufficient growing area for roots. Plant roots may have a tendency to stay in the richly amended soil and not spread into surrounding soils, resulting in constricted root systems and loss of vigor due to excessive root competition in a confined area. Highly amended soil may be too rich for some plants, making them prone to problems and requiring higher maintenance. Excessive nitrogen and phosphorus may also cause pollution.

In rare circumstances the soil may be so poor or contaminated that the best approach is to replace the soil prior to planting. For soils contaminated with toxic elemental species, refer to the section on Toxic Elemental Species. Any contaminated soil must be disposed of in accordance with all state and local laws. Imported soil may contain hazards such as weed seeds, invasive plant material, and pollutants. Be aware that there is ecological damage created when topsoil is mined.

Whether the soil is enhanced or not, choosing the right plant for the right place will yield consistently good results and will help to ensure the long-term health and sustainability of any planting.

Preferred

- Preserving desirable existing native vegetation whenever possible
- Choosing plants that match existing site conditions
- Using soil found on site, as available and appropriate
- Manually removing (stripping) unwanted vegetation and roots in areas to be planted
- Composting unwanted vegetation on site for future use
- Smothering vegetation with old natural fiber rugs, layers of non-corrugated cardboard, or organic matter
- Using amendments per soil test recommendations
- Incorporating amendments into the soil
- Mulching with organic matter (i.e., shredded leaves, compost—see Mulches)

Allowed

- Altering site conditions to accommodate a plant's cultural requirements
- Rototilling to remove unwanted vegetation
- Solarizing unwanted vegetation with black plastic sheeting (plastic should be removed and reused)

- Flame burning or scalding unwanted vegetation
- Using acid-based organic herbicides
- Composting debris off-site
- Using soil imported from off-site
- Mulching with bark or inorganic products (see Mulches)

Records must be kept (see appendix and Principles and Procedures section)

Prohibited

- Adding nitrogen, phosphorus or potassium without a soil test
- Adding amendments that result in soil and/or plant degradation or environmental damage
- Leaving amendments on the surface unprotected from runoff
- Disturbing protected areas such as riparian and wetland areas (obey all applicable laws)
- Using soil ammendments and fertilizers that are inconsistent with the *Standards* (see Soil Health section)
- Synthetic pesticides–including synthetic herbicides
- Synthetic fertilizers
- Synthetic wetting agents and water-retaining polymers

Cover Crops, Green Manures And Crop Rotations

Overview

Cover crops and green manures help maintain soil organic matter, add nitrogen, reduce leaching of soluble nutrients, make insoluble nutrients more available to the next crop, prevent erosion, interrupt disease and insect pest life cycles, and suppress weeds. They are particularly useful in temporarily covering bare soil, and in establishing and maintaining small-scale vegetable gardens and annual flower beds. When a green manure or cover crop is turned under, its organic matter and nutrient content feed the soil biota, which in turn feed the next crop. Although cover crops and green manures cannot be rotated with perennial crops, benefits accrue from cover crops planted prior to perennial crops or between rows or plants.

A few guidelines: Wait one to two weeks after turning under a green manure before planting. This allows residues to break down and release their nutrients. If rye or other non-legumes have become too mature before turning under, they may temporarily bind soil nitrogen and take longer to break down. Nitrogen is wasted when a lush, succulent legume is turned under more than two weeks before planting another crop. This should never be done in the fall because it may release soluble nitrogen, which is vulnerable to leaching. Where a crop is removed and not allowed to recycle on the site, crop rotation can bolster the health of the soil. Growing the same vegetables or annual herbs repeatedly on the same piece of ground invites disease and depletion of nutrients in the soil. Where possible, a crop rotation plan is strongly urged. Often it may incorporate the use of green manures. Alternate light and heavy feeders, legumes and non-legumes. It is also best to follow a crop with one that has different or complementary nutritional needs. Avoid growing two successive crops that are from the same plant family or are subject to the same pests or diseases. Finally, minimize the length of time the soil is bare.

Seeds, Transplants and Plant Material

Every effort should be made to find sources of organically-grown seeds and plants or to produce them oneself. Growers of plant materials sold as "Certified Organic" should follow the guidelines listed under "Seeds, Seedlings and Greenhouse Practices" in the NOFA/Massachusetts Organic Certification Standards for agriculture and "Seeds and Transplants" in the CT NOFA Organic Certification Standards for agriculture.

Preferred

- All shrubs, trees, seedlings, plugs, rootstocks and other propagative forms of plants from certified organic sources
- Organically-grown seeds
- Nontoxic seed treatments such as hot water soaks and legume inoculants

Allowed

- Conventionally-grown shrubs, trees, seedlings, plugs, rootstocks and other propagative forms of plants and untreated seeds
- Pelletization (of seeds) that does not contain prohibited materials

Prohibited

- Use of prohibited pesticides, soil fumigants or synthetic fertilizers on any seedling or plant materials
- Fungicide-treated seeds
- Genetically-modified seeds and plants
- Synthetic rooting or wetting agents
- Use of prohibited practices or materials (referenced elsewhere in the Standards) on seedlings or plant materials
- Removal, harvest, or collection of any rare, endangered or threatened plant (including seeds) from its natural habitat
- Planting commercially-propagated rare, endangered, or threatened plant species (to preserve the genetic integrity of wild populations of these plants)

Pruning

Overview

Our first thought should be to "Do no harm." Organic land care practitioners are expected to care about what they do and possess the knowledge, the proper tools, and necessary licenses and/or certifications to do the job. Because plants are living systems, it is important to know how these systems work and how to work within them. Since living systems use gradual processes to grow, our practices should avoid methods that cause fast results or drastic changes. Poor pruning practices can result in a weak, unsightly plant or even cause death. Many of the old pruning practices have been proven harmful. Therefore, education in proper pruning methods is very important.

Plants should be encouraged to grow as their genetics dictate, not as we determine. Whenever possible, leave the shaping and shearing for Disney! Leaves are the "food factories" of a plant. All plant food generated by a plant is manufactured in the leaves. The more leaves, the more potential to make food. The plant knows best how many leaves it needs and in what spatial arrangements. Our job is to disturb this process as little as possible when pruning—especially with older, less vigorous plants.

The optimum time to prune living wood is when the plant's energy reserves are high. For most plants this is in late winter, before buds begin to swell. Pruning in late fall or early-mid winter can result in dieback and disease/insect problems because the dormant plan cannot seal off the wound created by the pruning cut. If pruning is necessary during the growing season, wait at least two weeks after the leaves have matured to allow the plant to make and store energy. When removing (pruning) woody tissue, it is important to make a clean, smooth pruning cut in the proper location. The swollen area where a branch is joined to the plant at a crotch is called the branch bark collar. All pruning should be done just outside this collar, leaving a short stub. Do not tip prune or "top" a plant. This practice only leads to disfigurement and weak plants. Much of the plant's energy for growth is stored in the tips and buds (symplast) and should be preserved as much as possible during pruning. When size reduction is necessary, it is healthier for the plant to remove an entire branch back to the main trunk or leader (drop crotch pruning) than it is to prune back the tips.

In many states (CT included) you must be licensed to prune woody plants for hire.

Preferred

- Removing deadwood, diseased wood, and crossed and intersecting wood as soon as it is noticed
- Pruning living tissue when energy reserves are high
- Corrective pruning for mechanical stability done when plants are young and wood is less than 3 inches in diameter
- Using drop crotch pruning methods
- For size reduction, removing one-third of the branches back to the trunk or main leader over a period of several seasons
- Pruning at the proper time to ensure proper bud formation
- Rejuvenation pruning of a multi-stemmed plant by removing one-third of the oldest wood to the ground over a 3-year period
- Disinfecting pruning tools after their use on diseased wood, or removing diseased wood during the dormant season
- Disposing of pruning debris by composting on site

Allowed

- Corrective pruning to improve mechanical stability when wood is larger than 3 inches in diameter
- Rejuvenating a multi-stemmed plant by removal of all stems at one time
- Removing pruning debris to an off-site recycling facility
- Shearing

Prohibited

- Any practice that results in, or contributes to, the decline of health of desirable plants
- Topping
- Removing excessive symplast tissue (tips and buds)
- Leaving portions of branches during size reduction
- Using tree gaffs (climbing spikes) while pruning, except for emergency rescue

Lawn & Lawn Alternatives

Overview

Lawn is an area of land covered with a close-cropped plant cover, usually grass. Lawns are suitable for recreational use, for pathways where light foot traffic occurs, and as separations between different land uses. Well-kept lawn areas can be visually appealing, but they are a high-maintenance component of an organic landscape. Limiting the size of lawn areas to only what is necessary is less costly to maintain, easier to care for, and better for the environment. For instance, lawn used for a child play area can be converted to a more ecological planting regime when no longer needed.

Most types of grasses in use today for lawns in the Northeast are sun-loving, sod-forming, cool-season species of European descent. Their genetic predisposition is to grow tall, produce flowers and seed, and become dormant during the hot, dry summer. The typical way lawns are maintained--namely, continuous mowing close to the ground, which does not allow flower or seed production, and forcing the grass to stay green and growing throughout the warm season by use of inputs such as pesticides, fertilizer and water-- is contradictory to their natural habits. Growing grass this way pushes these plants beyond their genetic limits and causes plant stress, resulting in more inputs to keep the grass green and growing. Overuse of high-maintenance grass can cause environmental damage, resulting in reduced health for all living things. The manufacture and use of machinery for installing and maintaining lawns creates air, water, soil, and noise pollution. Other factors that contribute to environmental and biological degradation from high-maintenance lawns include: the manufacture and use of pesticides and fertilizers; increased surface-water runoff and subsequent soil erosion; and reduced biodiversity. The ecological sustainability of high-maintenance lawns must be questioned, and their use curtailed.

There are appropriate low-maintenance lawn alternatives. In sunny areas, native grass and grass-like species that are drought-tolerant, nutrient-efficient, disease-resistant, and low-growing can be used. Incorporating certain leguminous (nitrogen-fixing) broadleaf plants such as clovers and trefoil into the grass mix adds diversity and durability, as well as naturally supplying nitrogen to the lawn. For sunny areas that will not be frequently mowed, mixtures of native grasses and/or wildflowers can be used to plant a meadow garden. The “no mow” grass mixes are another alternative. In areas of moist or dry shade there are alternative native, low-maintenance grasses and other plants that would thrive where other grasses would fail. In areas too shady for grass to grow, the use of appropriately selected, shade-tolerant, low-maintenance perennials, shrubs and trees can add beauty and increase the biodiversity of the landscape. Special attention should be given to the use of plants that are native to the region to increase local biodiversity. In marginal areas of the landscape, just allowing the lawn that already exists (free of invasive species) to grow “wild” will provide an economical, ecological, and sustainable alternative to the high-maintenance lawn, and provide food and cover for wildlife.

New Lawn Installation

Proper installation of a new lawn is essential for its long-term beauty and health, and reduces the need for excessive inputs. Soil testing is the first step (see **Soil Testing**). Installation of a new lawn is best undertaken in late summer or early fall, and can be accomplished in several ways. One of the key elements of a successful new lawn is properly prepared soil. Choose a soil type that is close to neutral pH and has a balanced fungal to bacterial ratio. After a proper seedbed is prepared (see **Planting Bed Preparation**), soil amendments, as specified by the soil test results, are incorporated into the seedbed. Then an appropriate mix of seeds can be sown by hand, or using a spreader or seed driller, or in conjunction with a liquified mulch that is pressurized and sprayed onto the soil (hydroseeding). Care

should be taken to identify all ingredients in a hydroseeding mixture to ensure they are approved for organic use. Be careful to choose a seed mixture that is adapted to, and tolerant of, the particular growing conditions of the site. There are many insect- and/or disease-resistant, sun- or shade-tolerant species and cultivars to choose from. Endophytically-enhanced grass seed protects the grass from surface-feeding insects but should not be used where the grass may be used as food or feed for ruminant animals, as it will sicken them. Always use several different species and cultivars in the mix to enhance diversity and increase the chances of success. Ensure good seed-to-soil contact by lightly rolling or dragging the seed into the soil. Use a mulch that is as weed-free as possible, such as sterilized straw, to enhance germination and control erosion. The seedbed should be watered frequently but shallowly. The ideal situation is to maintain a "uniformly moist" seedbed during germination and establishment. Watering should increase in duration but decrease in frequency once the root system has become established. After several mowings and in the absence of hot, dry weather, watering should gradually be decreased. Watering should be eliminated when not necessary. Sodding is another form of lawn establishment that provides instant coverage and looks impressive right away. Unfortunately, much sod is grown using high-maintenance grass species and large amounts of synthetic inputs and water to meet the demand for cheap, readily available sod. At least one New England sod grower uses sewage sludge as a growing medium and soil amendment. The sod can be so dependent on synthetic chemicals and devoid of organic matter that it may not have the ability to assimilate organic forms of nutrients. The use of humates, compost, compost teas, fish hydrolyzates, carbohydrates, microbial inoculants, biostimulants, root stimulants, and/or soil flocculants is sometimes necessary to detoxify and reestablish the biology in the root zone of the sod and break down the thick thatch layer evident in some sod. A sodded lawn can often cost several times more and require higher inputs than a lawn properly installed and maintained from seed. There are new, more ecological seed mixes, especially fescues, being developed and used in sod production,

Lawn Renovation

Lawn renovation is a method of rejuvenating a partially damaged lawn. It is also useful for filling in bare spots. Lawns may require rejuvenation to repair insect, disease, or drought damage and soil compaction, and also to improve vigor and appearance. By adding different varieties of grass, we can improve wear tolerance, decrease disease susceptibility and increase site adaptability. All these changes can alter the dominant plant regime from high maintenance to low maintenance.

The soil should be tested beforehand (see **Soil Testing**) to determine the quantity and types of nutrients that are needed (if any) and the soil pH. If thatch is more than 1/2 inch thick, the lawn could be mechanically de-thatched. If time allows and thatch is not excessive, it can be eliminated naturally by increasing the number of microorganisms which produce enzymes that break down thatch, and by boosting their vigor by adding carbohydrates such as sugar, molasses, or dextrose via compost and compost tea. Proper pH is very important to the development of a healthy and vigorous lawn and to the vigor of these microbes.

If thatch is over an inch thick, mechanical removal is necessary, using a vertical slicing machine (a.k.a. vertical mower, not a power rake). De-thatching with a vertical slicing machine is done with two passes perpendicular to each other. The blades must be set low enough to slice completely through the thatch layer and slightly into the soil. Where thatch is light to moderate, the use of core-aerating machinery may be sufficient. Excessively thick or tough thatch can be reduced by using a core aeration machine in conjunction with the vertical slicing machine. Thatch should be reduced to 1/8inch– 1/4inch before amending the soil or seeding. The duff material that comes to the surface after de-thatching should be removed and composted as long as no persistent herbicides have been applied. If contaminated with persistent herbicides, compost the duff separately and return it to the lawn. See **"Caution: Herbicide Contamination of Compost"** in **Compost**.

Any pernicious weeds should be eradicated by hand pulling, smothering, stripping, or the use of organic herbicides (see below). Bare soil areas should be lightly cultivated or filled with a compost/topsoil mix prior to seeding. Mulch and water as described above. For seeding bare spots after corn gluten has been applied, mix grass seed with a 50/50 mix of compost and topsoil and apply at a minimum of 2 inches thick, then mulch and water as described above.

Lawn Maintenance

The ongoing sustainability of a properly installed lawn is dependent upon proper maintenance. For high-maintenance lawns, fertility levels and appropriate soil pH should be adequately maintained by judicious use of soil amendments, determined by soil testing. The quantity of inputs can be decreased, and the number of nitrogen-fixing bacteria in the soil increased, by returning grass clippings to the lawn, mulching shredded leaves into the lawn in the fall, using nitrogen-fixing plants in the lawn mix, and applying bacterial compost. See **Compost** for specifications for bacterial compost.

Mow using a well-maintained, properly operated mower with a sharp blade. No more than one-third of the grass blade should be removed at one time, resulting in grass height maintained at three inches or taller. When there is a history of persistent herbicides used on the lawn, the grass clippings must remain in place. The herbicide residues do not break down readily in composting and are a hazard to many broadleafed plants. See **"Caution: Herbicide Contamination of Compost" in Compost** .

When needed, fertility can be added to the lawn in several ways: by adding organic matter, returning grass clippings and leaves to the soil; by using a blended organic fertilizer; by using plants in the lawn that fix nitrogen; and by applying individual nutrients. When using compost, spread it evenly in a thin layer approximately 1/4 inch thick. This can be done in both spring and early fall. Proper watering is necessary to prevent damage or death during extended drought. On healthy, established turf, systematic watering is generally not necessary and is not recommended. Water is a precious resource requiring large amounts of energy and infrastructure to deliver, and must be conserved. Lawns watered regardless of need eventually become dependent on it. If watering an established lawn becomes necessary, it should be watered deeply, to a depth of 6 inches or more, and infrequently, allowing the soil to partially dry out between waterings to allow gas exchange between the soil and the atmosphere. Too much water will fill the pore spaces in the soil, suffocating roots and soil life and increasing the likelihood of disease. Watering should be timed and the saturation depth checked to determine how long to water a particular area, based on the soil type. Do not water to the point of runoff (see **Water**).

Insects and diseases in the lawn require careful consideration prior to the application of any control. Pesticides—even organic ones—can result in death of beneficial life forms. It is very important to accurately identify the pest and know its life cycle and how it damages the grass plant. A healthy soil harbors copious amounts of active microbial life forms and humus, which remedy imbalances that can prevent a pest outbreak. Many times a pest is not present in numbers high enough to warrant control. Other times a natural control (predator, antagonist, etc.) may be present, preventing serious damage without intervention. Do not initiate a pest control measure unless damage exceeds economic and/or esthetic thresholds. Consult local cooperative extension publications for thresholds. As a long-term response, cultural methods such as planting resistant cultivars or endophytically-enhanced varieties, or improving air circulation should be implemented. If control becomes necessary, use organically approved pesticides as a last resort. Before applying any pesticide, read and understand the label instructions and warnings and follow all applicable laws (see Pest Management).

“Weeds” are tolerated in an organic lawn to varying degrees. Many so-called weeds are beneficial to the lawn ecosystem. It wasn’t until the advent of selective herbicides that a lawn consisted of only grasses. Before that, any plant that lived under the mower blade was considered “lawn.” In many cases it is time to return to that mindset. If weed control is necessary, there are several organic products on the market

approved for use. Corn gluten meal may suppress the establishment of plant seeds when used as a pre-emergent. It is applied in the spring, before weeds emerge, usually between forsythia and lilac bloom. It can be reapplied in early summer before germination of late season weeds. Corn gluten meal is high in protein and thus contains approximately 10% organic nitrogen. This nitrogen needs to be figured into the total allowable amount of nitrogen applied per year (see **Fertilizers and Soil Amendments**). Unwanted weeds that already exist in the lawn can be organically controlled with the use of selective herbicides based on plant materials or non-selective herbicides made from ethanoic and acetic acids or potassium salts of fatty acids. Cautiously spot spray weeds, being careful to avoid any unnecessary overspray or drift onto desirable lawn or plants. Because these herbicides are nonselective, they will kill or deface living green tissue on contact. Care should be taken not to get any spray on the body. As with any pesticide, read and understand the label before use and follow all applicable laws.

Preferred

- Lawn seed mixtures consisting of low-maintenance grasses, broadleaf plants and/or legume varieties appropriate for the site
- Lawn alternatives, such as low-mow lawns, native grasses and wildflowers, native or low-maintenance perennials, herbs, shrubs and trees.
- Allow lawn to grow unmowed
- Recreation and pedestrian areas that utilize mulch, sand, etc., instead of turfgrass (Note: for playgrounds, there are Americans with Disabilities Act standards to consult)
- Disease- and/or insect-resistant grass cultivars
- Mow to maintain a height of 3 inches or more
- Irrigation by natural rainfall only, except for new seeding
- Return grass clippings and shredded leaves to the lawn
- Have soil tested to determine nutritional needs prior to application of amendments
  Thatch removal using thatch-reducing soil amendments, when feasible

Allowed

- Appropriately-sized lawn, but only where it will grow well
- Mowing at less than 3 Inches in height, but not less than 2 inches, except for sports turf
- Proper mechanical irrigation (see **Water**)
- Removing grass clippings and/or leaves if composted and used on-site, if persistent herbicides have not been used in the past
- Blended organic fertilizers, as required by soil test
- Soil conditioners & biostimulants
- Application of minor amounts of organic rock powders, that do not contain nitrogen, phosphorus or potassium, without soil testing
- Conventionally-grown sod, only in conjunction with a detoxifying program when necessary and only where it will grow well without additional inputs
- Mechanical thatch removal when thickness is more than ½ inch
- Maintenance of existing lawns in wetlands or riparian areas with little or no inputs

- Cultivars bred to remain green under low nitrogen use
- Core aeration when adding soil amendments

Prohibited

- Planting lawn within a wetland or riparian border
- Genetically modified organisms (e.g. Roundup-Ready® grass seed)
- Monoculture stands of a single species of turfgrass
- Cultivars of turfgrass that are known to be disease- and/or insect-prone
- Species and cultivars of turfgrass with high nutrient and watering requirements
- Synthetic pesticide, or synthetic fertilizer or soil conditioner use
- Biosolids or sewage sludge
- Grass types containing endophytically-enhanced grasses where the grass may be grazed
- Mowing less than 2” in height, except for sports turf
- Excessive irrigation resulting in runoff, compaction and/or disease
- Application of nitrogen, phosphorus, or potassium without soil testing
- Any methods or materials not approved for organic use
- Removing grass clippings when persistent herbicides have been applied in the past

Appropriate Plant Choices

Native verses Exotic Plants

About Invasive Plants

Native plants evolved in harmony with their environment over millions of years. During this evolution, native plants adapted to their habitat in relationship to other species of plants, insects, animals, and other life forms to create an intricate web of life that is in balance and self regulating.

The colonization of North America has had a profound impact on native plant communities and the wildlife that depends on them. The burgeoning human population and associated development have altered the landscape and reduced natural areas to a handful of fragmented parcels. Meanwhile, humans have introduced, either accidentally or intentionally, a large variety of exotic plants that have spread rapidly, and become pests in natural or minimally-managed habitats such as woodlands, grass lands and sea shores.

Approximately 85 percent of the invasive woody plant species in the United States were introduced for landscape or ornamental use.[1] There are approximately 50,000 foreign species and the number is increasing. About 42% of the species on the Threatened or Endangered species lists are at risk primarily because of alien-invasive species.[2]

Invasive plants often have a competitive advantage over natural flora. They often out-compete local native plants for sunlight, water and soil nutrients. Invasives may have few or no natural enemies to keep populations in balance with the rest of the local ecosystem. This often greatly reduces biodiversity in an area, creating monocultures, where only the invasive plant grows.

Invasive plants have a severe economic impact. According to researchers, “invading alien plant species in the United States cause major environmental damages and losses adding up to almost $120 billion per year.”[2]

Not all non-native plants are invasive. In fact, most are not. Many of our beautiful ornamental plants and the majority of our fruits and vegetables are not native to the United States and are not invasive. The qualities which cause certain plants to be called "invasive" are defined by different state governments and organizations in different ways, but generally, invasive plant species are those which show unrestrained growth and out-compete (crowd out) native species. Invasive plants create significant changes in the composition, structure and ecology of the natural environment, sometimes producing monocultures that entirely displace the original, native species in the ecosystem. This can result in a disruption of the entire ecosystem's food chain, affecting not only other plants, but soil chemistry and structure, insects, birds, reptiles, mammals and so on.

A species that is native to one area may become invasive in another. Each part of our planet Earth has areas that share specific characteristics, such as weather conditions, geological formations, amount of rainfall, type of soil, etc. that makes it different from other areas. These different areas support the plants and animals that have evolved to survive in that area over hundreds of thousands of years. These areas are called "bioregions".

Regional, state and federal governments / agencies are now in the process of developing "banned" and "watch" lists for their specific bioregions. Banned plants may be illegal to move, sell, purchase, transplant, cultivate or distribute. Since these lists are being developed and changing rapidly, we suggest consulting that list of invasive species Web sites that is provided in Appendix at the end of this book.

In states that do not have a banned lists, many invasive species are still commonly available from wholesale and retail nurseries, and invasive species are also still being sold via the Internet. Land care professionals are urged to use regionally native plants wherever possible, and when considering exotic plants, to use only those plants that are known not to have invasive tendencies.

Studies have shown that it can take up to 20 years from first introduction for a plant to become invasive and begin to cause problems in the natural landscape. Therefore, the precautionary principle should be applied when deciding which plants to use in an organic landscape: a plant whose invasive potential is unknown should not be planted. Although the magnitude of these problems is enormous, the land care professional and home gardener can play a key role in restoring the natural balance by choosing to plant native plants over exotics and controlling invasive species on the properties they manage.

The Cultivar Debate

There is currently a debate among scientists as to what and what does not qualify as a cultivar, and if all cultivars of certain invasive species are all invasive. A general definition of cultivar is: a subdivision of a species, cultivated variety of plant produced by horticultural techniques not normally found in wild populations, selected for some feature that distinguishes it from the species from which it was selected. Cultivars are generally developed to enhance a certain desirable trait, such a dwarf size, variegated leaves, or color of flowers or leaves.

Long term studies are being conducted to see if there are any cultivars of invasive species, such as Burning Bush *(Euonymus alata)* and Japanese Barberry (*Berberis thunbergii*) that are barren (do not produce any viable seeds.) Research thus far has shown that even cultivars that are currently being marketed as being sterile do indeed produce viable seeds. Whether or not researchers can develop a truly sterile cultivar is yet to be seen.

Why Native Species?

Some believe that it is always preferable to plant native species over exotic ones. Native plants have adapted to their bioregion's climate, soil conditions, insect pests and pathogens over the long period of evolutionary time. Delicate natural systems and cycles are kept in balance by the contributions each species makes to the whole web of life. Use of native species promotes regional biodiversity and is beneficial for native wildlife. Native plants also preserve the 'sense of place' and add to the entire sensory experience of a landscape.

What is Native?

There is certainly a lot of debate as to what is "native". Generally, a plant is considered "native" if it was growing in the area prior to the arrival of Europeans. Beyond that, each land care professional may have to make their own decisions about where they are willing to draw their "native" circle. If the property is located in the Western part of the state of Massachusetts, for example, you may consider a plant native if it naturally grows in the Berkshire region, or if it grows in New England, or if it grows anywhere in the Eastern United States. One way to decide what to plant might be to study the local wild landscape and mimic that as closely as possible, always taking into account microclimates (small areas which may get more or less moisture, have different soil, sun and temperature variations, etc.) when planting.

Preferred

- Native species. Most preferred would be to use plants organically propagated within that bioregion, from seed or cuttings (not cloned)
- Cultivars of species native to the local bioregion
- Plants that perform multiple functions (food for wildlife, shade to reduce building energy cooling needs, wind breaks to reduce building heating needs, etc.)

Allowed

- Plants native to other parts of North America and not known to be invasive in the place that they will be planted -- check local regulations
- Plants appropriate to the ecology and microclimate in which they will be planted. Consider the growing environment: soil type, drainage, amount of sun, shade or wind the plant will get
- Non-native, non-invasive species

Prohibited

- All plants considered to be invasive in that state or state's region (For Web sites that list which plants are considered invasive in which states, please refer to the Appendix.)
- All cultivars derived from invasive species, including hybrids of invasive and non-invasive species.
- Removal, seed collection or destruction of native plants from the wild, the roadside, public or private land, particularly removal of threatened or endangered species. It is

encouraged to rescue plants that will be destroyed by development, but get permission first! Check with land owner, and local regulations.

Treatment of Existing Invasive Plants

Where appropriate, it is strongly recommended that invasive and potentially invasive plants (as identified in the state lists) be removed from all sites under management. Land care professionals must first be sure to correctly identify a plant as invasive. Removal should be in accordance with organic practices whenever possible.

It is critical to know what species you are working with and the best way to remove it and dispose of the plant matter after it is removed. For example, certain invasive plants may be pulled or dug, but extreme care must be exercised to prevent further propagation from root, stem fragments, or other propagules. Or, disturbance of the soil caused by digging may bring invasive plant seeds to the surface. Best removal methods vary by plant, and can include manually pulling, smothering, biological controls. Best organic removal methods are still being studied. To provide the reader with the most up-to-date information, we have provided a list of Web sites that give specific removal instructions for each type of invasive in Appendix.

When removal of an invasive plant is not possible or the client refuses to allow it, the plant should, if at all feasible, be pruned immediately after the first flowers begin to fade to reduce or prevent the formation of seed. All flower parts should be removed and composted in a manner that will keep the seed from maturing. It is critical to understand the life cycle and seed dispersal mechanism of a species in order to use this method effectively.

After invasive plants are removed, it is important to fill the void with a plant, nurse crop, cover crop, or mulch, so that new seeds will be less likely to sprout and replant with native species as soon as possible to prevent re-colonization by invasives.

Avoid Spreading Invasives

As stewards of the environment, it is critically important that land care professionals do everything possible to avoid spreading invasive plants. Unfortunately, it is very easy to inadvertently spread invasives. In addition, it may be difficult to identify invasive species, so it is always take precautionary measures. There are two common means of spreading invasives unintentionally: on landscaping equipment and by dumping cut materials.

Landscaping equipment, whether it is a shovel, lawn mower or excavator, all has the potential to spread invasive plants short and long distances. Seeds, root and stem pieces, and other propagules can all be transported on blades, parts and in tire grooves. Transporting invasive plants is obviously bad for the environment, but could also be a liability risk for the land care professional. This is why it is very important to thoroughly clean equipment between properties, manually, with a power washer, or both. If water is used to clean equipment, it is imperative to make sure that washing is done over a permeable managed surface, such as a lawn, and not on a surface such as a driveway, where wash water will run off into storm water sewers, or local water bodies.

Some states have laws specifying that cut invasive plant material must be kept on site. This is generally a good idea for most all sites. Most property owners will agree to have a compost area once the benefits of this are explained to them. Unfortunately, most compost piles do not get hot enough to kill invasive plants. And since many invasive plants will continue to grow and spread even after they are removed form the soil, it is important to kill as much of the plant as possible before disposing of it into a compost pile. The general recommendation is to dry out invasive material for several weeks on an impervious surface, such as a driveway. Then chip the material finely and compost on site. If you know of a facility that burns trash, you can also bag the material and bring it directly to the trash burning facility, without having to dry it out first. For more resources on invasive plants see the appendix and http://www.organiclandcare.net/invasiveresources.htm .

Preferred

- Avoid disturbing native habitat
- Hand pulling
- Hand-powered mechanical means (e.g., Weed Wrench, a tool designed specifically for removing invasive woody plants)
- Repeatedly cutting down woody plants with hand tools after first flush of growth to wear down root energy reserves thereby causing death by starvation
- Digging with hand tools
- Boiling water poured directly over roots
- Mowing with a push mower
- Smothering with a thick layer (more than 4 inches) of weed-free mulch, paper under mulch, or a temporary covering with non-PVC containing plastic
- Girdling
- Animal grazing/browsing
- Beneficial insects

Allowed

- Motorized equipment
- Pruning to remove flowers and/or seeds to prevent spreading, if removal isn't an option
- Solarization, which is the use of clear plastic to raise the temperature of the soil and essentially "cook" plants and the soil. This may also kill the beneficial microorganisms, so that after the plastic is removed, the area might benefit from compost or compost tea applications.
- Flame weeders or prescribed burning (MUST be trained and must contact local fire department for approval)
- Organically approved herbicides based on ethanoic and acetic acid (Burn Out) or potassium salts of fatty acids (Scythe is pelargonic and related fatty acids). MUST have pesticide applicator's license! Caution-- these can be dangerous to applicator. Check local pesticide laws.

Prohibited

- Synthetic herbicides (including glyphosate formulations such as Roundup or Rodeo)

FOOT NOTES:

1. Reichard, S.H. and White, P., "Horticulture as a Pathway of Invasive Introductions in the United States," BioScience 51: 103-13 (2001).

2. Pimentel, David, Rodolfo Zuniga, and Doug Morrison, "Update on the Environmental and Economic Costs Associated with Alien-Invasive Species in the United States," Ecological Economics 52: 273-88 (2005). 2005.

GLOSSARY:

Biodiversity is the variation of life forms within a given ecosystem, biome or for the entire Earth. Biodiversity is often used as a measure of the health of biological systems.

Bioregion is the next smallest ecologically and geographically defined area beneath "realm" or "ecozone". Eco-regions cover relatively large areas of land or water, and contain characteristic, geographically distinct assemblages of natural communities and species. The biodiversity of flora, fauna and ecosystems that characterize an eco-region tend to be distinct from that of other eco-regions.

Cover Crop is any annual, biennial, or perennial plant grown as a monoculture (one crop type grown together) or polyculture (multiple crop types grown together), to improve any number of conditions associated with sustainable agriculture. Cover crops are fundamental, sustainable tools used to manage soil fertility, soil quality, water, weeds (unwanted plants that limit crop production potential), pests (unwanted animals, usually insects, that limit crop production potential), diseases, and diversity and wildlife.

Cultivar is a subdivision of a species, cultivated variety of plant produced by horticultural techniques not normally found in wild populations, selected for some feature that distinguishes it from the species from which it was selected. Cultivars are generally developed to enhance a certain desirable trait, such a dwarf size, variegated leaves, or color of flowers or leaves.

Flora refers to all plant life occurring in an area or time period, especially the naturally occurring or indigenous plant life. The term flora comes from Latin language Flora, the goddess of flowers in Roman mythology. The corresponding term for animal life is fauna.

Girdling is a method of killing unwanted woody plants by making continuous incisions through the bark and underlying living tissues, completely around the tree stem. Girdling "starves" roots by depriving them of sugars produced in the leaves. Care should be taken, as girdling some trees cause them to topple over.

Microclimate is a local atmospheric zone where the climate differs from the surrounding area. The term may refer to areas as small as a few square feet (for example a garden bed) or as large as many square miles (for example a valley). Microclimates exist, for example, near bodies of water which may cool the local atmosphere, or in heavily urban areas where brick, concrete, and asphalt absorb the sun's energy, heat up, and reradiate that heat to the ambient air: the resulting urban heat island is a kind of microclimate.

Monoculture is the practice of producing or growing one single crop over a wide area.

Nurse crop, is an annual crop used to assist in establishment of a perennial crop. The widest use of nurse crops is in the establishment of leguminous plants such as alfalfa, clover, and trefoil. Occasionally nurse crops are used for establishment of perennial grasses. Nurse crops reduce the incidence of weeds, prevent erosion, and prevent excessive sunlight from reaching tender seedlings. Often the nurse crop can be harvested for grain, straw, hay, or pasture. Oats are the most common nurse crop, though other annual grains are also used.

Propagate is the production of more plants by seeds, cuttings, grafting, cloning or other methods.

Propagule is any plant material used for the purpose of plant propagation. In asexual reproduction, a propagule may be a woody, semi-hardwood, or softwood cutting, leaf section, or any number of other plant parts. In sexual reproduction, a propagule is a seed. In micropropagation, a type of asexual reproduction, any part of the plant may be used, though it is usually a highly meristematic part such as root and stem ends or buds.

Solarization is the use of clear plastic to raise the temperature of the soil and essentially "cook" plants and the soil. This may also kill the beneficial microorganisms, so that after the plastic is removed, the area might benefit from compost or compost tea applications.

Weeds

Overview

A weed has been defined as a plant out of place, whose attributes perhaps have not yet been discovered. It is important to distinguish between "weeds" in the yard and invasive plants causing havoc in natural ecosystems.

Preventive measures can eliminate many weed problems before the weeds become established. The choice of methods for weed control should be made carefully to reduce the number of trips over the landscape, save fossil fuels and avoid soil compaction. Overuse of a rototiller can burn up organic matter quickly and reduce the soil to powder. All machinery and equipment should be in good condition to prevent contamination of soil, edible crops or plants (at any stage of production) with motor oil, hydraulic fluid, grease, or fuel. Hand tools should be sharpened and well maintained for efficient action. Careful cleaning of tools and equipment after working in weedy areas is highly recommended.

The key to weed control is timing. Careful observation of weed populations and weed seedling emergence patterns after disturbance will help the landscaper develop an appropriate weed control program. Careful cultivation prevents the formation of large weed populations.

Preferred

- Avoiding conditions that favor weeds: compacted soils or overtillage; overwatering; and excessive nitrogen
- Adjusting soil biology or chemistry to favor desired plants over weeds
- Covering the ground with desired plants that out-compete weeds
- Weeds in beds containing woody and/or perennial plants are hand weeded, spot sprayed with organic herbicides, smothered with mulch, or cultivated by hand
- Weed-free mulches to suppress weeds (see Mulches)
- Vertical edging or repeated hand edging between lawn and garden bed areas to prevent grass from infiltrating
- Overseeding cover crops such as annual ryegrass into bare spots on lawns or white clover or buckwheat into vegetable garden row crops
- Timely mechanical or hand cultivation
- Shallow cultivation to avoid bringing more weed seeds to the surface
- Boiling water poured slowly and directly over the weed root

Note: for weeds in lawns, see Lawn and Lawn Alternatives Section

Allowed

- Plastic mulches that do not contain polyvinyl chloride (PVC), including landscape fabric
- Paper mulch beneath an organic mulch
- Flame weeders
- Hot water weed burners
- Vinegar or salt if used only on walkways or terraces where weeds emerge between cracks
- Corn gluten —only one application per year of 20 pounds per 1,000 square feet (see Nitrogen section for limits on additional nitrogen in the same year). Note that corn gluten may contain genetically modified organisms
- Organically approved herbicides based on ethanoic and acetic acid or potassium salts of fatty acids

Prohibited

- All synthetic herbicides, arsenates, and caustic acids or salts
- Synthetic growth regulators
- Diesel products
- Petroleum distillates
- Micronutrients in toxic quantities
- Synthetic transpiration repressants

Issue of Special Concern: Poison Ivy

Care must be taken in handling this plant. Poison ivy fruit is an important food source for birds. For this reason, in areas not frequented by people, leave poison ivy intact whenever feasible. The following procedures are suggested for its removal from an area where humans or domesticated animals will have contact with it.

Do not burn

For hand pulling:

- Use non-absorbant, protective gloves that completely cover the arm from fingers to shoulder
- Apply protective material before handling
- Gather plants in bags and dispose of entire collection in the trash. Take care to protect anyone who may come in contact with the trash.
- Be sure to weed out the entire root system to prevent resprouting. Repeated weeding may be needed.
- Wash gloves completely with naptha-based soap before removing them to dry

Grazing

Sheep and goats will browse poison ivy without harm to themselves. Repeated grazing is necessary to eradicate the plant.

Mulches

Overview

Mulch is a layer of material—either organic or inorganic—applied to the soil surface. It performs functions that are usually beneficial to the ecosystem. The natural tendency of soils in this bioregion is to be covered with plant material—either alive, dead or both. It is this layer that performs many functions that are vital to plant and soil health. Organic mulches mimic this natural soil cover by adding organic matter, humus and natural fertilizer, providing a substrate for beneficial microorganisms, retaining moisture, controlling erosion, moderating soil temperature fluctuations, and aiding weed suppression. However, fresh wood mulch high in carbon may immobilize nitrogen and should be avoided. Inorganic mulches are less desirable because they do not contribute to soil or plant health and are usually more ecologically harmful to produce and transport. However, they may sometimes be preferable because many of them can be reused or do not need to be replenished as often as organic mulches.

The proper application of mulch is very important. Too much mulch suffocates life in the soil, affects water permeation, and starves the roots. Mulch piled up against the trunks of plants can cause the bark to rot, leaving the cambium layer under the bark vulnerable to damage. Dormant buds at the base of the trunk can be forced to sprout into surface roots (adventitious roots) that have no alternative but to grow in the mulch layer where there is little or no food or protection. Lastly, herbivores can cause serious damage to trunks by tunneling through the mulch and feeding on the bases of plants. This damage is especially prevalent in winter.

Preferred

- Mulching bare ground as soon as possible before soil is damaged by the elements
- Mulching of seeded areas to prevent erosion
- No more than a three- to four-inch layer of mulch at any time around woody plants, keeping the mulch a minimum of four inches away from trunks
- No more than a two- to three-inch layer of mulch at any time adjacent to herbaceous plants, keeping the mulch away from their crowns
- Replenishing mulch to maintain and not exceed the above depths
- Applying a winterizing mulch after the ground has frozen, to ensure a dormant root system throughout the winter
- Anchoring engineered mulch blankets on slopes having a three percent grade or greater with pegs and twine, netting or mats (check mulch blankets and anchoring devices for prohibited materials before use)
- Living mulches (i.e., annual and perennial rye, hairy vetch, winter rye, oats) to quickly cover areas of bare soil with growth or improve soil quality
- Compost, composted leaves, wood chips
- Sawdust (only for acid-loving plants)
- Buffering materials (e.g. compost) to prevent “shocking” of soil microorganisms when using mulch materials that are at the extreme ends of the pH scale
- A layer of composted leaves or compost to prevent bark mulch from coming in contact with the soil

Allowed

- Un-composted leaves
- Bark (carries high amounts of indigestible fats, waxes and lignans)
- Buckwheat hulls or cocoa bean hulls
- Newsprint containing only black ink

- Stone and gravel (mined substances)
- Plastic and polyethylene mulches free of PVC
- Weed barrier fabrics only if used in conjunction with washed gravel or stone
- Mulch layer exceeding 4 inches in total depth only when used to smother undesirable or invasive plants
- Corrugated cardboard

Prohibited

- Mulch layers exceeding four inches in total depth except when used to smother undesirable or invasive plants
- Mulch blankets and anchoring materials containing substances prohibited by these Standards (see Soil and Plant Contact Materials)
- Genetically modified seed for living mulches
- Colored ink and glossy paper
- Weed-barrier fabrics beneath organic mulch (soil and other organic matter will clog the pore system of the fabric and prevent air and water from penetrating into the soil below)
- Dyed mulch which may contain demolition debris contaminated with lead paint, pressure treated wood or other toxic substances

Pest Management

Insects and Other Arthropods

Overview

The primary way to prevent and limit pest problems is to grow healthy plants. This is accomplished by growing the right plant in the right place, in order to limit stress from unsuitable conditions, and by developing healthy soil. Not all pest outbreaks are harmful to the long-term survival or health of the plant. An outbreak can be a temporary phenomenon quickly eliminated by natural enemies without human intervention, and the plants recover. Client education may be needed on this issue.

Any direct pest control measure requires a pest management plan, which should include regular monitoring of plant health and pest density. When selecting a method of pest control, it is important to seek the most specific control for the problem pest, in order to avoid harming beneficial organisms. For information on thresholds, consult publications from your cooperative extension office or Agricultural Experiment Station.

All relevant laws should be followed in the application of any material used as a pesticide (including biological products and botanical pesticides). State certification as a pesticide applicator is required for any commercial application of pesticides. Check with your state government about the need for specific licenses in specific situations.

Commercial application of materials for pest management is illegal unless the materials are registered by the Environmental Protection Agency (except for the 25b materials discussed below) and the state government, and labeled for that plant and site. The label is the law, including restrictions on crop or plant species, rates, and requirements for worker protection. If you are an employer who uses any type of pesticides, including organic pesticides, you should make sure you are in compliance with requirements for worker protection (such as use of protective clothing, reentry intervals, decontamination, and emergency medical assistance). More information on the Worker Protection Standard is available from the U.S. Environmental Protection Agency (EPA) at the website: http://www.epa.gov/oecaagct/htc.html. In addition, signs and neighbor notification may be required, depending on the law in your state.

You can check to find out if a product is registered in your state by contacting the responsible state regulatory official (a list of state pesticide control officials is at http://aapco.ceris.purdue.edu/htm/control.htm). An additional source is Kelly Solutions, which keeps a database of registered pesticides for 36 states (http://www.kellysolutions.com/), but the final word always comes from the responsible state official.

An increasing number of pest management products classified as “minimum risk pesticides” and thus exempt from EPA registration have come on the market in recent years. These are often referred to as “25b” pesticides after the section of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) that created this exemption from Federal registration. The criteria for exemption from registration are that all active ingredients and inert ingredients are on the respective EPA lists of materials considered to be non-toxic, and that the label meets certain specific requirements. Note that 25b materials are not currently required to demonstrate efficacy against pests, so let the buyer beware.

Although 25b pesticides are exempt from Federal registration, state registration may still be required in many states. In addition, the rules for commercial application of these products still apply. State pesticide certification is required for commercial application of 25b products. EPA

registered or 25b products labeled for home use may also be used by a professional in a residential setting as long as the label does not specifically prohibit professional use.

Preferred

- Pest-resistant plant species and varieties
- Careful inspection to detect and remove any infestation before planting
- Diversifying plant species and varieties to avoid monocultures
- Conservation or improvement of habitat for natural enemies of pests (such as planting flowers that provide pollen and nectar to beneficial insects)
- Making the environment unsuitable for the pest (such as the use of wood chips as a barrier to movement of ticks)
- Removal and proper disposal or composting of infested plant parts or of alternate hosts for pests
- Timely planting of annual plants with attention to pest life cycles

Allowed

- Note that except for mechanical measures, releasing live predators or parasites, and using glue to seal pruning wounds, all of the allowed methods below refer to using EPA registered or 25b pesticides based on the active ingredients listed below and without inert ingredients on the EPA List of Inert Ingredients of Toxicological Concern.

- Mechanical measures, such as traps, nets, hand picking or vacuuming
- Pheromones or other attractants used for monitoring or trapping pests or for mating disruption
- Releasing predators or parasites, such as lacewing eggs or larvae, parasitic wasps, or insect-attacking nematodes
- Releasing insect or arthropod pathogens, such as Milky Spore® bacteria or *Beauveria bassiana* (when not genetically engineered)
- Insecticides whose active ingredients are extracted from naturally occurring microbes, such as Bt (*Bacillus thuringiensis*) or spinosad
- Insecticidal soaps (these can result in damage to some plants, and must be carefully applied)
- Sprays of oils derived from plant or animal sources
- Horticultural oil sprays (dormant, suffocating and summer oils) derived from petroleum distillates
- Plant extracts derived from hot peppers or garlic, or plant essential oils, such as clove oil (eugenol), floral extracts (2-phenethyl propionate), thyme oil (thymol), rosemary oil, or wintergreen oil.
- Botanical insecticides, such as pyrethrum or neem,. Note that these are broad spectrum poisons, hazardous to humans, wildlife and soil organisms as well as beneficial insects. They should be used with discretion and not on a regular basis. They must not be formulated with EPA List 1 inert ingredients. All label restrictions must be followed, including proper protective clothing for the applicator.
- Boric acid for ant control
- Diatomaceous earth (protection is needed against breathing dust) if labeled in your state
- Common glue (casein) to seal pruned rose canes against borer damage

Prohibited

- All synthetic insecticides, including neonicotinoids, synthetic insect growth regulators, pyrethroids, carbamates, organophosphates, and piperonyl butoxide as an insecticide synergist

- All soil fumigants
- Nicotine
- Mothballs
- All other long-term poisons, such as arsenic
- Genetically engineered organisms, toxins or plants
- Any pesticide formulated with any inert ingredient on the EPA List 1: Inert Ingredients of Toxicological Concern. (See appendix or http://www.epa.gov/opprd001/inerts/list1chemname.pdf for this list). List 1 inerts are required to be listed on the label.

Snails & Slugs

- In most landscapes, snails and slugs can be tolerated and cause only insignificant plant damage. However, when they are present in large numbers in a bed of newly-planted, tender seedlings, they can weaken or kill the plants.

Preferred

- Modification of the environment to make the habitat drier and to eliminate protected hiding places for snails and slugs
- Planting non-preferred plant species
- Slug-attacking nematodes (if they become available—a species is currently in use in Britain)
- Copper or zinc strips or mesh used as barriers
- Traps
- Predation by chickens or ducks

Allowed

- Slug baits with iron phosphate as the active ingredient
- Diatomaceous earth (protection is needed against breathing dust) if labeled in your state for use against slugs in landscapes
- Barriers of sawdust or wood ash
- Caffeine-based pesticides (if they become available)

Prohibited

- Slug or snail bait with synthetic molluscicides (such as metaldehyde)

Disease Control

Overview

Plant pathogenic organisms infecting turf, herbaceous plants, and woody ornamental trees and shrubs include fungi, bacteria, viruses, nematodes, and phytoplasmas. These organisms can be dispersed by wind and water, insects, mites, and other organisms, by contaminated tools and equipment, and by human activities such as planting, pruning, and cultivating. Although these organisms are usually present in the environment, they often infect stressed or weakened plants. As a consequence, the key to disease management is prevention by maintaining plant and soil health. A disease management program should consist of a program for managing plant health that includes scouting and prevention. Client education is another important component of disease management since not all plant diseases require or warrant aggressive strategies for control. For example, foliar leaf spots are considered cosmetic or aesthetic diseases as compared with blights or dieback diseases, which have significant implications for plant health.

All relevant laws should be followed in the application of any material used as a pesticide This includes biological and botanical products used as pesticides. State licenses are required for commercial application of any pesticides. Check with your state government about the need for additional licenses that might be required to care, prune, or apply pesticides in certain situations.

It is illegal to apply materials for disease management unless they are registered by the Environmental Protection Agency and the state government and are labeled for specific plants and diseases. The label is the law, including restrictions for use on a crop or plant species and requirements for worker protection (such as use of protective clothing and reentry intervals). In addition, posting signs and neighbor notification may be required, depending upon the laws in your state.

Preferred

- Building and maintaining healthy fertile soil, rich in organic matter, with balanced nutrients, pH, and trace elements (see Soil Health). Nutrient toxicities and deficiencies can weaken plants and make them more vulnerable to diseases as well as secondary pathogens or opportunistic pests. Potassium has also been identified as an element that can enhance disease resistance.
- Maintaining proper soil pH for the plant species (usually 6.4-7.0)
- Planting disease-resistant species and varieties
- Avoiding monocultures. For example: A monoculture of perennial rye grass can be heavily infected by rust. However, if the lawn had been planted with 2-3 other grass species, the highly susceptible perennial rye grass would be infected but the other types of grass might be resistant or tolerant of the infection
- Carefully checking for symptoms and signs of disease on nursery stock before purchasing trees, shrubs, or sod and by checking the root systems for evidence of disease prior to planting.
- Using adequate spacing to promote and encourage overall plant health and good air circulation.
- Using good sanitation practices. Pruning dead, dying, damaged, or diseased branches. Removing infected leaves, twigs, branches, needles, and cones around the base of trees and shrubs in the fall to remove sources of inoculum. Removing infected grass clippings from the lawn or eliminating infected hosts and replanting with disease-resistant cultivars. Infected plant debris should be properly composted or removed from the site.
- Developing a plant health care plan. This should include scouting to detect and identify diseases as early as possible. Scouting should be done at least twice a month for trees and

shrubs and if possible, once a week for turf. In time, trends develop and "hot spots" of disease activity emerge. These hot spots are often consistent and are usually associated with microclimates that exist in most landscapes. Plotting these areas on a map works well for future reference. It is also helpful to consult with local extension service, Experiment station, or university personnel to keep informed about what other professionals are seeing in the field and obtain results of disease forecasting or other prediction models.

Allowed

- Preparations of beneficial microbes with EPA labels as biocontrol agents that antagonize or compete with specific plant pathogens.
- Potassium bicarbonate
- Insecticidal soaps
- Plant-derived anti-desiccants and anti-transpirants
- Plant or microbe-derived products used to enhance plant growth and improve soil health
- Hydrogen peroxide
- Copper products (e.g., copper sulfate, copper sulfur)
- Sulfur
- Lime sulfur
- Neem products
- Refined (horticultural) oils used as dormant and growing season applications

Prohibited

- All synthetic chemical fungicides
- Petrochemical based anti-desiccants

Wildlife Management

Overview

Priority must be given to living in harmony with nature and creating habitat for native wildlife. (See information on planting for wildlife in Bibliography and Sources of More Information in the Appendix.) However, in the case of injury to plantings, circumstances may require diversion, repellents, exclusion or control. Care must be taken to accurately identify the animal species causing damage through identification of tracks, scat, behavior and type of damage before a control method is determined. State and local laws pertaining to live trapping, hunting and removal of animals must be observed at all times.

Preferred

- Plants not generally eaten by major pests such as deer (keeping in mind that native plants are recommended—see Appendix for lists of preferred and non-preferred plants)
- Tree wraps of chicken wire
- Fencing, including electric fencing
- Dogs and cats as discouragements
- Herbal or vegetable-based repellent preparations
- Human hair placed around the area's perimeter
- Mechanical or visual scaring devices
- Diversion plantings (planting favored plants in wildlife corridors)
- Companion planting of repellent plants (caution: some species are poisonous to humans)
- Barrier hedgerows (of non-invasive species)
- Soap bars hanging from trees (repellent to deer)
- Netting
- Locating susceptible plants in areas where humans are highly active and visible
- Aromatic plants placed where deer will trample them (overwhelms their sense of smell)

Allowed

- Hinder deer repellent (ammonia-based)
- Miller's hot sauce animal repellent (caution: very hot)
- Non-injurious trapping and removal (consult state laws about what to do with trapped animals)
- Rodenticides with active ingredient Vitamin D3
- Dogs and cats as discouragements
- Sulfur dioxide smoke bombs for underground rodent control only
- Dried blood or animal renderings as a repellent (only from American cattle sources to avoid risks of infectious diseases—take precautions to avoid direct human contact—may contain pathogens)

Prohibited

- Leghold traps and other traps that cause slow death
- Rodenticides with an active ingredient other than Vitamin D3
- Predator urine (due to inhumane conditions of collection)
- Diesel fuel and kerosene-based spray
- Cyanides, strychnine, phosgene bombs, and other gas-producing devices
- Products containing sewage sludge (e.g. milorganite)

Disposal Guidelines For Garden Renovation Projects

Overview

Organic Land Care Professionals should comply with local town or city regulations regarding the disposal of any nondegradable materials such as pressure-treated lumber, concrete, asphalt or other building debris. Dumpster rental may be required. Disposal of degradable materials, such as stumps, logs and brush may also be regulated locally or by state statute.

Preferred

- On-site composting of degradable materials
- Grinding stumps and brush to chips for reuse
- Disposing of invasive plant material appropriately to prevent spread (see Invasive Plants)

Allowed

- Composting off-site
- Removing stumps and brush to off-site composting facility
- Other disposal methods in accordance with state laws and local ordinances (such as burning)

Prohibited

- Dumping off-site in unauthorized areas
- Disposal of invasive plant material that could lead to its spread

APPENDIX

Bibliography and Sources of More Information

Organizations of General Interest, Their Publications and Websites

National Sustainable Agriculture Information Service (ATTRA). Provides information about sustainable agriculture. Publications include: list of soil testing labs, composting, compost teas, sustainable lawn care. ATTRA - Sustainable Agriculture Information Service , P.O. Box 3657, Fayetteville AR 72702; 800 346-9140, English; 800 411-3222, Español; www.attra.org

Bio-Integral Resource Center (BIRC). Least toxic pest management. Publications include: *The IPM Practitioner* and *Common Sense Pest Control Quarterly*. BIRC, P.O. Box 7414, Berkeley CA 94707; 510 524-2567; www.birc.org

Connecticut Agricultural Experiment Station. Publications, soil testing, identification of pests and plant diseases. CAES, P.O Box 1106, 123 Huntington St., New Haven CT 06504. Insect inquiries: 203 974-8600. Plant inquiries: 203 974-8601. Soil testing: 203 974-8521. General Information: 203 974-8500. Windsor Valley Laboratory: 860 683-4977; www.caes.state.ct.us

Ecological Landscaping Association. Educational workshops and forums. 1257 Worchester Rd, #262, Framingham MA 01701, 617 436-5838; www.ecolandscaping.org

Neighborhood Network. Membership organization with classes and trade shows of organic products. Neighborhood Network, 7180 Republican Airport, East Farmingdale, NY 11735; 631 963-5454; www.longislandnn.org

New England Wild Flower Society at Garden in the Woods. Membership organization offering education and information about the use of native plants in the landscape. 180 Hemenway Road, Framingham MA 01701; 508 877-7630; www.newfs.org

Northeast Organic Farming Association. This is a regional organization, with chapters in 7 states. The Connecticut and Massachusetts chapters have joined together to form the NOFA Organic Land Care Program, which wrote the *Standards*. CT NOFA: PO Box 164, Stevenson, CT 06491; 203 888-5146; www.ctnofa.org. NOFA/Mass: 411 Sheldon Rd., Barre MA 01005; 978 355-2853; www.nofamass.org

Northeast Organic Farming Association Organic Land Care Program. www.organiclandcare.net Program Manager: PO Box 164, Stevenson, CT 06491; 203-888-5146; Massachusetts Coordinator: 53 Carter Pond Rd., Petersham, MA 01366; 617-576-0810.

Organic Materials Review Institute. Reviews materials for adherence to organic crop production standards (on which our *Standards* for materials are based). www.omri.org

University of Connecticut, Cooperative Extension System, College of Agriculture and Natural Resources, 1376 Storrs Road, University of Connecticut,, Unit 4066, Storrs, CT 06269; 860 486-2917; www.cag.uconn.edu/canr/index.html

University of Massachusetts Cooperative Extension Service. Amherst MA 01003; www.umassextension.org

USDA Natural Resources Conservation Service. 344 Merrow Road, Tolland, CT 06084; 860 871-4011; www.ct.nrcs.usda.gov

USDA Natural Resources Conservation Service. Massachusetts office website: www.ma.nrcs.usda.gov

Organic Principles and Methods

Coleman, Eliot. *The New Organic Grower*. Chelsea Green, Chelsea Vermont. 1989.

Smith, Miranda. *The Real Dirt: Farmers Tell About Organic and Low-Input Practices in the Northeast*. Sustainable Agriculture Publications. 1994.

Waters, Charles Jr. and C. J. Fenzau. *An Acres U.S.A. Primer*, Acres USA. 1979.

Organic Standards

1994 Standards for Certification of Organic Lawn Care Professionals in the Northeastern United States: The Experience of a Program of Ecological Turf Management. The Certification Committee of the Ecological Landscaping Association, Greenfield, Massachusetts.

National Rule for Organic Agricultural Production. The rule released by the US Department of Agriculture became effective 10/21/2002. www.ams.usda.gov/nop/indexIE.htm

Organic Farm Certification Standards and Administrative Procedures. Northeast Organic Farming Association of Connecticut, Inc. Northford, Connecticut. 2000.

The NOFA Massachusetts Organic Certification Program. Northeast Organic Farming Association /Massachusetts Chapter, Inc. 2000.

General Gardening and Landscaping

Ball, Jeff and Liz Ball. *Landscape Problem Solver: A Plant-by-Plant Guide*. Rodale Press. Emmaus, Pennsylvania. 1989.

Beautiful…Bountiful Landscapes. Rodale Press. Emmaus, Pennsylvania. 1985.

Bradley, Fern Marchall and Barbara W. Ellis, editors. *Rodale's All-New Encyclopedia of Organic Gardening: The Indispensable Resource for Every Gardener*. Rodale Press. Emmaus, Pennsylvania. 1992.

Cox, Jeff. *Your Organic Garden* . Rodale Press. Emmaus, Pennsylvania. 1994.

Flowerdew, Bob. *Bob Flowerdew's Organic Bible: Successful Gardening the Natural Way*. Kyle Cathie Limited. London. 1998.

Green, Douglas. *Landscape Magic: Tricks & Techniques for Rejuvenating Old Yards & Gardens*. Chapters Publishing, Ltd. Shelburne, Vermont. 1995.

Planting and Maintaining Sustainable Landscapes: A Guide for Public Officials and the Green Industry. University of Massachusetts Extension.

Site Management and Analysis

Allaby, Michael. *A Dictionary of Ecology*, second edition. Oxford University Press, Oxford. 1998.

Connecticut Department of Environmental Protection and U.S. Soil Conservation Service. *Manual of Best Management Practices for Agriculture: Guidelines for Protecting Connecticut' s Water Resources*. 1993.

Damrosch, Barbara. *The Garden Primer*. Workman Publishing. 1988.

USDA Natural Resources Conservation Service. *Heavy Metal Soil Contamination*. Technical Bulletin #3. Available from NRCS Soil Quality Institute, 2150 Pammel Drive, Ames IA 50011; 515 294-4592; or online at soils.usda.gov.

Soil Care, Composting, Fertilizers, and Soil Amendments

Backyard Composting: Your Complete Guide to Recycling Yard Clippings. Harmonious Technologies, Harmonious Press, Ojai, California. 1992.

BioCycle: Journal of Composting & Organics Recycling. The JG Press, Inc.

Campbell, Stu. *Improving Your Soil*. Garden Way Publishing Bulletin A-20. Garden Way Publishing. Pownal, Vermont. 1978.

Gershuny, Grace and Joseph Smillie. *The Soul of Soil: A Guide to Ecological Soil Management,* 2nd edition. Gaia Services. 1986.

Gershuny, Grace. *Start With The Soil: The Organic Gardener's Guide to Improving Soil for Higher Yields, More Beautiful Flowers, and a Healthy, Easy-Care Garden*. Rodale Press, Emmaus, Pennsylvania. 1993.

Hemenway, Toby. *Gaia's Garden*. Chelsea Green. 2001.

Ingham, Elaine R. 2002. The Compost Tea Brewing Manual. Third Edition. Soil Foodweb, Inc. Corvallis, Oregon.

Kinsey, Neal and Charles Walters. *Hands-on Agronomy*. Acres, U.S.A. Metairie, Louisiana. 1999.

Magdoff, F. and H. van Es. *Building Soils for Better Crops*, 2nd ed. Sustainable Agriculture Publications. Hills Building, University of Vermont, Burlington, 05405-0082; 802 656-0484.
Make Compost in 14 Days. Rodale Press. Emmaus, Pennsylvania. 1982.
Minnich, Jerry, and Marjorie Hunt. *The Rodale Guide to Composting*. Rodale Press. Emmaus, Pennsylvania. 1979.
Natural Fertilizers for the Home Garden. Cooperative Extension, College of Resource Development, University of Rhode Island.
NPK of compost materials. Primal Seeds. Online at: www.primalseeds.org/npk.htm.
Parnes, R. *Fertile Soil: A Growers Guide to Organic and Inorganic Fertilizers*. 1990. Fertile Ground Books. PO Box 2008, Davis, CA 95617.
Sachs, Paul D. *Edaphos: Dynamics of a Natural Soil System*. The Edaphic Press. Newbury, Vermont. 1993.
Soil Biology Primer. Soil and Water Conservation Society. 2000. Available from 1 888-LAND-CARE or by e-mailing landcare@swcs.org.
U.S. Department of Agriculture, Natural Resources Conservation Service/Soil Quality Institute. *Agronomy Technical Note Series*. Provides introductions to cover crops, crop rotation, toxic elemental species in soils, and other topics. Available from NRCS Soil Quality Institute, 2150 Pammel Drive, Ames IA 50011; 515 294-4592; or online at soils.usda.gov

Invasive Plants and Weeds

Capers, Robert S., Gregory J. Bugbee, Roslyn Selsky and Jason C. White. A guide to Invasive Aquatic Plants in Connecticut. Bulletin No. 997. January 2005. www.ct.gov/caes/lib/caes/documents/invasive_acquatic_plants/aquatics_guide.pdf
Element Stewardship Abstracts, The Nature Conservancy. In depth information about invasive plants. tncweeds.ucdavis.edu/esadocs.html
Gilman, Steve and Jocelyn Langer, illus. *Organic Weed Management*. Organic Principles and Practices Handbook Series, Northeast Organic Farming Association/Massachusetts. Barre, Massachusetts. 2000.
Hellquist, C. Barre. *A Guide to Invasive Non-native Aquatic Plants in Massachusetts.* Massachusetts Department of Environmental Management, Lakes and Ponds Program. Boston, Massachusetts. 1997.
Invaders. *New England Wildflower* Vol. 2, No. 3 (1998) Conservation Notes of the New England Wild Flower Society. Framingham, Massachusetts. Website: www.newfs.org/conserve/
Pfeiffer, E. *Weeds and What They Tell*. Biodynamic Farming and Gardening Association. 1970.
Plant Conservation Alliance Alien Plant Working Group. *Weeds Gone Wild: Alien Plant Invaders of Natural Areas*. www.nps.gov/plants/alien. Maintains a national list of exotic plants that are infesting natural areas.
Randall, John and Janet Marinelli, editors. *Invasive Plants: Weeds of the Global Garden.* Brooklyn Botanic Garden Publications. 1996.
Reichard, Sarah Hayden and Clement W. Hamilton. Predicting Invasions of Woody Plants Introduced into North America. *Conservation Biology* Volume 11, No. 1, 1997. Pages 193-203.
University of Connecticut. *Invasive Plants*. On line at invasives.eeb.uconn.edu/ipane for the New England Invasive Plants Atlas and www.hort.uconn.edu/cipwg for the Connecticut Invasive Plants Working Group.
Weatherbee, Pamela B., Paul Somers and Tim Simmons. *A Guide to Invasive Plants in Massachusetts*. Massachusetts Division of Fisheries & Wildlife. 1998.

Native Plants

Cullina, William. *Native Trees, Shrubs, and Vines: A Guide to Using, Growing and Propagating North American Native Woody Plants*. Houghton Mifflin, 2002.
Cullina, William. *The New England Wild Flower Society Guide to Growing and Propagating Wildflowers of the United States and Canada*. Houghton-Mifflin. 2000.

Dowhan, Joseph J. *Preliminary Checklist of the Vascular Flora of Connecticut (Growing Without Cultivation)*. Connecticut Geological and Natural History Service. Reports of Investigations, #8. 1979.
Hightshoe, Gary, *Native Trees, Shrubs and Vines for Urban and Rural America*. Iowa University. 1978.
Native Shrubs for Landscaping. Connecticut College Arboretum.
Picone, Peter, *Connecticut Native Tree and Shrub Availability List*. Connecticut Department of Environmental Protection, Hartford CT (undated).
Sauer, Leslie Jones. *The Once and Future Forest*. Island Press. 1998.
Sorrie, Bruce A. and Paul Somers. *The Vascular Plants of Massachusetts: A County Checklist*. Massachusetts Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program. 1999.
The Wild Gardener in the Wild Landscape. Connecticut Department of Environmental Protection. Hartford.

Pest Management

Ellis, Barbara W. and Fern Marshall Bradley, editors. *The Organic Gardener's Handbook of Natural Insect and Disease Control: A Complete Problem-Solving Guide to Keeping Your Garden and Yard Healthy without Chemicals*. Rodale Press. Emmaus, Pennsylvania. 1996.
Harley, Ruth. *"SCAT:" Pest-Proofing Your Garden*. Garden Way Publishing Bulletin A-15. Garden Way Publishing. Pownal, Vermont. 1977.
Johnson, Warren T. and Howard H. Lyon. *Insects that Feed on Trees and Shrubs*. Cornell University Press. 1976.
Leslie, Ann R. *Handbook of Integrated Pest Management for Turf and Ornamentals*. Lewis Publishers. 1994.
Olkowski, William, Sheila Daar, and Helga Olkowski. *Common-Sense Pest Control*. Taunton Press. 1991.
Tashiro, Haruo. *Turfgrass Insects of the United States and Canada*. Cornell University Press. 1987.
USDA Forest Service website on hemlock wooly adelgid: www.fs.fed.us/na/morgantown/fhp/hwa/hwasite.
Welch, Kenneth A. and Timothy M. Abbey. Pesticide Guide Toward Integrated Pest Management for Connecticut Arborists. *Department of Entomology, Connecticut Agricultural Experiment Station*. 2006. Available from Connecticut Tree Protective Association, 1-888-919-2872
Yepsen, Roger B., Jr. *Organic Plant Protection: A Comprehensive Reference on Controlling Insects and Diseases in the Garden, Orchard and Yard without Using Chemicals*. Rodale Press. Emmaus, Pennsylvania. 1976.

Disease Control

Chase, A., Margery Daughtrey and Gary Simone. *Diseases of Annuals and Perennials*. A Ball Guide. Identification and Control. Ball Publishing. Batavia, IL 1995.
Douglas, Sharon. *Disease Management Guide for Connecticut Arborists*. 2007 – 2008. Available from Connecticut Tree Protective Association, 1-888-919-2872
Sinclair, Wayne A., Howard H. Lyon and Warren T. Johnson. *Diseases of Trees and Shrubs*. Cornell University Press. 1987.

Gardening with Wildlife

Backyard Stream and Pond Buffers. USDA Natural Resources Conservation Service. July 1999. Storrs, CT.
Antony, Doris P. *Planting for the Bees*. Rhode Island Wild Plant Society.
Lowe, Cheryl B. *Butterfly Gardening in New England*. New England Wild Flower Society and Garden

Club Federation of Massachusetts. 2000.
Picone, Peter. *Enhancing Your Backyard for Wildlife*. Connecticut Department of Environmental Protection. Hartford, CT. 1995.
Stokes, Donald and Lillian Stokes. *Bird Gardening Book*. Little, Brown & Co. 1998.
Stokes, Donald, Lillian Stokes, and Ernest Williams. *The Butterfly Book*. Little, Brown & Co. 1991.
Ward, Jeffrey S. *Limiting Deer Browse Damage to Landscape Plants*. Connecticut Agricultural Experiment Station Bulletin #968. November 2000.
Xerces Society. *Butterfly Gardening: Creating Summer Magic in Your Garden*. Smithsonian Institution. 1990.

Trees, Other Woody Plants, and Their Care

Dirr, Michael A. *Manual of Woody Landscape Plants*, Fifth Edition.
Harris, Richard A. *Arboriculture—Care of Trees, Shrubs, and Vines in the Landscape*. 1983.
Plant Health Care for Woody Ornamentals: A Professional's Guide to Preventing and Managing Environmental Stresses and Pests. International Society of Arboriculture, Savoy, Illinois and Cooperative Extension Service, College of Agricultural, Consumer and Environmental Sciences, University of Illinois at Urbana-Champaign. 1997.
Sauer, Leslie Jones, *The Once and Future Forest*. Island Press. 1998
Shigo, Alex L. *A New Tree Biology Dictionary: Terms, Topics and Treatments for Trees and Their Problems and Proper Care*. Shigo and Trees, Associates. Durham, New Hampshire. 1986.
Shigo, Alex L. *A New Tree Biology: Facts, Photos, and Philosophies on Trees and Their Problems and Proper Care.* Shigo and Trees, Associates. Durham, New Hampshire. 1997.
Shigo, Alex L. *Modern Arboriculture: A Systems Approach to the Care of Trees and Their Associates*. Shigo and Trees, Associates, Durham, New Hampshire. 1991.
Standard Practices for Tree Care Operation—Tree, Shrub, and Other Woody Plant Maintenance. ANSI A300 (Part 3), Supplement to ANSI A30-1995. American National Standards Institute, New York. 1999.
Sustainable Trees and Shrubs. Third Edition. University of Rhode Island Cooperative Extension Landscape Horticulture Program. 1999. Latest edition available by calling 401-874-2900.
The Arborist Law. Connecticut Department of Environmental Protection.
The Connecticut Arborist. Connecticut Tree Protective Association Publications.

Perennials and Annuals

Hansen, Richard and Friedrich Stahl, *Perennials and their Garden Habitats*. Fourth edition. Timber Press. 1993.
Ogden, Shepherd. *Step by Step Organic Flower Gardening*. HarperCollins. 1995.
Osborne, Robert. *Hardy Roses: An Organic Guide to Growing Frost- and Disease-Resistant Varieties*. Garden Way. 1991.
Still, Steven. *Manual of Herbaceous Ornamental Plants*. Stipes Publishing, Champaign, IL. 1994.
Wilde, Barbara. *Growing Roses Organically*. Rodale Press. 2002.

Lawns and Lawn Alternatives

Abbey, T., Editor. Turfgrass Nutrient and Integrated Pest Management Manual. 2001. University of Connecticut.

Bormann, Herbert, Diana Balmori and Gordon T. Geballe. *Redesigning the American Lawn*. Yale University Press. 1993.
Easy Lawns—Low Maintenance Native Grasses For Gardeners Everywhere. Brooklyn Botanic Garden, Handbook #160. 1999.
Ernst Conservation Seed Catalog. 9006 Mercer Pike, Meadville, PA 16335; 800 873-3321;

www.ernstseed.com
Franklin, Stuart. *Building a Healthy Lawn*. Garden Way Publishing.
Gershuny, Grace. *Start With The Soil*. Rodale Press. 1993.
Greer, Lane. *Sustainable Turf Care*. Appropriate Technology Transfer for Rural Areas (ATTRA). 1999. ATTRA, P.O. Box 3657, Fayetteville AR 72702; 800 346-9140; or online at: www.attra.org/attra-pub/turfcare.html
Prairie Nursery Catalog. P.O. Box 306, Westfield WI 53964; 800 476-9453; Website: www.prairienursery.com
Sachs, Paul D. *Handbook of $uccessful Ecological Lawn Care*. The Edaphic Press. Newbury, Vermont. 1996.
Schultz, Warren. *The Chemical Free Lawn*. Rodale Press. 1989.
The Natural Lawn & Lawn Alternatives. Brooklyn Botanic Garden, Handbook #136. 1995.
Vickery, Peter D. and Peter W. Dunwiddle. *Grasslands of Northeastern North America*. Massachusetts Audubon Society. 1997.

Horticulture/Pest Management Related Web Sites

State Sites

www.caes.state.ct.us	Connecticut Agricultural Experiment Station

Entomology

www.ent.iastate.edu/List/	Entomology Index of Internet Resources
www.ces.ncsu.edu/depts/ent/notes/O&T	North Carolina Cooperative Extension
www.bugguide.net	Identification for Insects, Spiders & Kin
www.tolweb.org	Tree of Life Web Project

Horticulture Information

www.hort.uconn.edu/cipwg	Connecticut Invasive Plant Working Group
www.CTPA.org/	Connecticut Tree Protective Association
128.241.193.252/index.aspx	Tree Care Industry Association
www.canr.uconn.edu/ces/forest/index.htm	University of Conn. Coop. Ext. Forestry
www.hort.uconn.edu/plants /index.html	University of Connecticut Plant Database
www.umassgreeninfo.org/	University of Massachusetts Green Industry
131.128.91.217/maynard_susplants/html_spl2000/index.htm	U. Rhode Island Sustainable Trees & Shrubs
www.uvm.edu/~pass/perry/	University of Vermont Perennial Page

State and National Agencies

www.aphis.usda.gov/	Animal & Plant Health Inspection Service
www.dep.state.ct.us	Connecticut Dept. of Env. Protection
www.ars-grin.gov/nigrp/robo.html	USDA Release of Beneficial Organisms

Integrated Pest Management

www2.oardc.ohio-state.edu/nematodes/	Insect Parasitic Nematodes
www.northeastipm.org	IPM in the Northeast Region
www.ipminstitute.org	IPM Institute
www.nature.nps.gov/biology/ipm/manual/ipmmanual.cfm	National Park Service IPM Manual
www.ipmworld.umn.edu/ipmsite.htm	Radcliffe's IPM World Textbook
www.nature.nps.gov/biology/ipm/manual/ipmmanual.cfm	Rutgers University Greenhouse IPM Notes

Turfgrass Information

www.ntep.org/contents2.shtml	National Turfgrass Evaluation Program
www.nysipm.cornell.edu/publications/lawn_care/ files/Lawn_Care_without_Pesticides.pdf	Lawn Care without Pesticides
www.conncoll.edu/ccrec/greennet/arbo/salt/salt.html	Smaller American Lawns Today

Soil Testing Laboratories

Each state land grant university and experiment station has a soil testing laboratory. This list is drawn from the publication "Alternative Soil Testing Laboratories" available from ATTRA (P.O. Box 3657, Fayetteville AR 72702, 800 346-9140) or online at www.attra.org/attra-pub/soil-lab.html.

Emphasis on Humus, Organic Matter, Compost, Microbial Analysis

Agri-Energy Resources
21417 1950 E St.
Princeton IL 61356
815 872-1190
815 872-1928 Fax
info@agrienergy.net
www.agrienergy.net

Midwest Bio-Systems
28933 35 E. Street
Tampico IL 61283
800 689-0714
815 438-7200 Fax
MBS@midwestbiosystems.com

Soil Foodweb, Inc.
728 SW Wake Robin Avenue
Corvallis OR 97330
541 752-5066
541 752-5142 Fax
info@soilfoodweb.com
www.soilfoodweb.com

Soil Foodweb New York
555 Hallock Avenue, Ste 7,
Port Jefferson Station, NY 11776
631-474-8848
631-474-8847 Fax
soilfoodwebny@aol.com
www.soilfoodweb.com

University of Massachusetts Soil Testing Lab
West Experiment Station
682 North Pleasant St.
University of Massachusetts
Amherst MA 01003-8021
413 545-2311
soiltest@umext.umass.edu
www.umass.edu/plsoils/soiltest/

Woods End Research Laboratory, Inc.
290 Belgrade Rd.
P.O. Box 297
Mt. Vernon ME 04352
207 293-2457
Contact: Dr. William Brinton
compost@woodsend.org
www.woodsend.org

Emphasis on Mineral Analysis and Fertilizer Recommendations

Agri-Balance Organic Consultants
P.O. Box 3083
Sag Harbor NY 11963
516 725-5725
516 725-2110 Fax
Contact: Elizabeth and Crow Miller
Soil Analysis for Organic Growing:

Cook's Consulting
RD #2, Box 13
Lowville, NY 13367
315 376-3002
Contact: Peg Cook
pegcook@northnet.org

Crop Services International Inc.
1718 Madison S.E.
Grand Rapids MI 49507-2518
616 246-7933
616 246-6039 Fax
Contact: Dr. Philip Wheeler
drdirt@cropservicesintl.com
www.cropservicesintl.com

International Ag Labs, Inc.
800 W. Lake Ave.,
P.O. Box 788
Fairmont MN 56031
507 235-6909
507 235-9155 Fax
Contact: Dr. Dan Skow, Wendell Owens
ilab@rconnect.com
www.aglabs.com

Kinsey's Agricultural Services
297 County Highway 357
Charleston MO 63834
573 683-3880
573 683-6227 Fax
Contact: Neal Kinsey
neal@kinseyag.com
www.kinseyag.com

Midwestern Bio-Ag
10955 Blackhawk Dr.,
P.O. Box 160
Blue Mounds WI 53517
800 327-6012
608 437-4441 Fax
Contact: Gary Zimmer
bioag@mhtc.net
www.midwesternbioag.com

University of Maine Soil Testing Service
Analytical Lab
5722 Deering Hall
Orono ME 04469-5722
Contact: Sue Erich - Lab Director
207 581-2997
207 581-3597 Fax
anlab.umesci.maine.edu

Lists of Invasive Plants

From: Mehrhoff, L.J., K.J. Metzler, and E.E. Corrigan. 2003. "Non-native Invasive and Potentially Invasive Vascular Plants in Connecticut. Center for Conservation and Biodiversity, University of Connecticut, Storrs; Connecticut Public Act No. 04-203: "An Act Concerning Fines for Banned Invasive Plants":; and "Invasive and Likely Invasive Plants: The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts," the final report of the Plant Evaluation Subcommittee of the Massachusetts Invasive Plant Working Group, March 12, 2003. prepared by Massachusetts Invasive Plant Group, Plant Evaluation Subcommittee, Draft September 23, 2002. For up-to-date information for the Northeast , see: www.pronewengland.org/INFO/PROInfoInvasiveNatRes.htm.

Note: Plants indicated with an * cannot **by law** be imported, moved, sold, purchased, transplanted, cultivated, or distributed in Connecticut.

Widespread and Invasive

Scientific Name	Common Name
Acer ginnala	Amur Maple
Acer platanoides	Norway Maple
**Acer pseudoplatanus*	Sycamore Maple
**Aegopodium podagraria*	Goutweed
**Ailanthus altissima*	Tree-of-heaven
Aira caryophyllea	Silver Hairgrass
**Alliaria petiolata*	Garlic Mustard
Allium vineale	Wild Garlic
**Amorpha fruticosa*	False Indigo
Ampelopsis brevipedunculata	Porcelain Berry
**Arthraxon hispidus*	Hairy jointgrass
Berberis thunbergii	Japanese Barberry
**Berberis vulgaris*	Common Barberry
**Bromus tectorum*	Drooping Brome-grass
**Butomus umbellatus*	Flowering-rush
**Cabomba caroliniana*	Fanwort
**Callitriche stagnalis*	Pondwater starwort
**Cardamine impatiens*	Narrowleaf bittercress
**Carex kobomugi*	Japanese sedge
**Celastrus orbiculatus*	Oriental Bittersweet
**Centaurea maculosa* (syn. *Centaurea biebersteinii*)	Spotted Knapweed
**Cirsium arvense*	Canada Thistle
**Cynanchum louiseae* (syn. *Vincetoxicum nigrum*)	Black Swallow-wort
**Cynanchumrossicum* (syn. *Vincetoxicum rossicum*)	Pale Swallow-wort
**Datura stramonium*	Jimson-weed
**Egeria densa*	Brazilian Water-weed
**Elaeagnus angustifolia*	Russian Olive
**Elaeagnus umbellata*	Autumn Olive
**Elsholtzia ciliata*	Crested late-summer mint
Epilobium hirsutum	Hairy Willow-herb
Euonymus alatus	Winged Euonymus

**Euphorbia cyparissias*	Cypress Spurge
**Euphorbia esula*	Leafy Spurge
**Fallopia japonica* (syn. *Polygonum cuspidatum*)	Japanese Knotweed
**Fallopia sachalinensis* (syn. *Polygonum sachalinense*)	Giant Knotweed
Frangula alnus (syn. *Rhamnus frangula*)	Glossy Buckthorn
**Froelichia gracilis*	Slender Snake Cotton
Geranium nepalense	Nepalese Crane's-bill
Glaucium flavum	Sea- or Horned Poppy
**Glechoma hederacea*	Ground Ivy
**Glyceria maxima*	Reed Mannagrass
**Heracleum mantegazzianum*	Giant Hogweed
**Hesperis matronalis*	Dame's Rocket
**Humulus japonicus*	Japanese hops
**Hydrilla verticillata*	Hydrilla
**Impatiens glandulifera*	Oriental Jewelweed
**Iris pseudacorus*	Yellow pond iris
**Kochia scoparia*	Summer Cypress
**Lepidium latifolium*	Perennial Pepperweed
**Ligustrum obtusifolium*	Border Privet
Ligustrum ovalifolium	California Privet
Ligustrum vulgare	European Privet
**Lonicera X bella*	Bella Honeysuckle
**Lonicera japonica*	Japanese Honeysuckle
**Lonicera maackii*	Amur Honeysuckle
**Lonicera morrowii*	Morrow's Honeysuckle
**Lonicera tatarica*	Tatarian Honeysuckle
**Lonicera xylosteum*	Dwarf Honeysuckle
**Lychnis flos-cuculi*	Ragged Robin
Lysimachia nummularia	Moneywort
**Lysimachia vulgaris*	Garden Loosestrife
**Lythrum salicaria*	Purple Loosestrife
**Marsilea quadrifolia*	Water Shamrock
**Microstegium vimineum*	Japanese Stilt Grass
Miscanthus sinensis	Eulalia
**Myosotis scorpioides*	Forget-me-not
**Myriophyllum aquaticum*	Parrotfeather
**Myriophyllum heterophyllum*	Variable Water-milfoil
**Myriophyllum spicatum*	Eurasian Water-milfoil
**Najas minor*	Brittle Water-nymph
**Nasturtium officinale* (syn. *Rorippa nasturtium-aquaticum*)	Watercress
**Nelumbo lutea*	American Water Lotus
**Nymphoides peltata*	Yellow Floating Heart
**Onopordum acanthium*	Scotch thistle
Ornithogalum umbellatum	Star of Bethlehem
**Paulownia tomentosa*	Princess Tree
Phalaris arundinacea	Reed Canary-grass
**Phragmites australis*	Common Reed
**Pistia stratiotes*	Water lettuce
**Poa compressa*	Canada Blue-grass
**Polygonum caespitosum*	Bristle knotweed
**Polygonum cuspidatum* (syn. *Fallopia japonica*)	Japanese Knotweed

Widespread and Invasive

Scientific Name	Common Name
**Polygonum perfoliatum*	Mile-a-minute Vine
**Polygonum sachalinense* (syn. *Fallopia sachalinensis*)	Giant Knotweed
**Populus alba*	White Poplar
**Potamogeton crispus*	Crispy-leaved Pondweed
**Pueraria montana (syn. Pueraris lobata)*	Kudzu-vine
**Ranunculus ficaria*	Lesser Celandine
Ranunculus repens	Fig Buttercup
**Rhamnus cathartica*	Common Buckthorn
Rhamnus frangula (syn. *Frangula alnus*)	European Buckthorn
Robinia pseudoacacia	Black Locust
**Rorippa microphylla*	Onerow yellowcress
**Rorippa nasturtium-aquaticum (*syn. *Nasturtium officinale)*	Watercress
**Rosa multiflora*	Multiflora Rose
Rosa rugosa	Rugosa Rose
**Rubus phoenicolasias*	Wineberry
**Rumex acetosella*	Sheep Sorrel
**Salvinia molesta*	Giant Salvinia
**Senecio jacobaea*	Tansy Ragwort
**Silphium perfoliatum*	Cup-plant
**Solanum dulcamara*	Bittersweet Nightshade
**Trapa natans*	Water Chestnut
**Tussilago farfara*	Coltsfoot
**Valeriana officinalis*	Garden-heliotrope
Veronica beccabunga	Brooklime
Vincetoxicum nigrum (syn. *Cynanchum louiseae*)	Black Swallow-wort
Vincetoxicum rossicum (syn. *Cynanchumrossicum*)	Swallow-wort

Restricted and Invasive

Scientific Name	Common Name
Ampelopsis brevipedunculata	Porcelain Berry
Egeria densa	Brazilian Water-weed
Humulus japonicus	Japanese hops
Hydrilla verticillata	Hydrilla
Lonicera maackii	Amur Honeysuckle
Lysimachia vulgaris	Garden Loosestrife
Polygonum perfoliatum	Mile-a-minute Vine
Rubus phoenicolasias	Wineberry
Tussilago farfara	Coltsfoot

Potentially/Likely Invasive

Scientific Name	Common Name
Acer ginnala	Amur Maple
Acer platanoides	Norway Maple
Acer pseudoplatanus	Sycamore Maple
Aira caryophyllea	Silver Hairgrass

Allium vineale	Wild Garlic
Amorpha fruticosa	False Indigo
Arthraxon hispidus	
Berberis vulgaris	Barberry
Bromus tectorum	Drooping Brome-grass
Butomus umbellatus	Flowering-rush
Callitriche stagnalis	
Cirsium arvense	Canada Thistle
Datura stramonium	Jimson-weed
Elaeagnus angustifolia	Russian Olive
Elsholtzia ciliata	Elsholtzia
Epilobium hirsutum	Hairy Willow-herb
Euphorbia esula	Leafy Spurge
Fallopia sachalinensis (syn. *Polygonum sachalinense*)	Giant Knotweed
Geranium nepalense	Nepalese Crane's-bill
Glechoma hederacea	Gill-over-the-ground
Glyceria maxima	Sweet Reedgrass
Heracleum mantegazzianum	Giant Hogweed
Impatiens glandulifera	Tall impatiens
Kochia scoparia	Summer Cypress

Potentially/Likely Invasive, continued

Scientific Name	**Common Name**
Ligustrum obtusifolium	Border Privet
Ligustrum ovalifolium	California Privet
Ligustrum vulgare	European Privet
Lonicera tatarica	Tatarian Honeysuckle
Lonicera xylosteum	European Fly-honeysuckle
Lychnis flos-cuculi	Ragged Robin
Marsilea quadrifolia	Water Shamrock
Miscanthus sinensis	Eulalia
Myriophyllum aquaticum	Parrotfeather
Najas minor	Eutrophic Water-nymph
Nelumbo lutea	American Water Lotus
Nymphoides peltata	Yellow Floating Heart
Onopordum acanthium	Scotch thistle
Ornithogalum umbellatum	Star of Bethlehem
Paulownia tomentosa	Empress-tree
Phalaris arundinacea	Reed Canary-grass
Poa compressa	Canada Blue-grass
Polygonum caespitosum	
Polygonum sachalinense (syn. *Fallopia sachalinensis*)	Giant Knotweed
Populus alba	White Poplar
Pueraria lobata	Kudzu-vine
Ranunculus repens	Creeping Buttercup
Rosa rugosa	Japanese Rose
Rumex acetosella	Sheep Sorrel
Silphium perfoliatum	Cup-plant
Solanum dulcamara	Climbing Nightshade
Valeriana officinalis	Garden-heliotrope
Veronica beccabunga	Brooklime

Lists of Plants Preferred and Not Preferred by Wildlife

Note that deer preference is relative and somewhat variable among sites. All plants within range will be damaged when the deer density is very high.

From: "Backyard Stream and Pond Buffers", USDA NRCS, 7/99, Storrs, CT.

Some plants considered less palatable to beaver are: spruce, white cedar, hemlock, tamarack, beech, red maple, and white birch.

Plant that are preferred by beaver: poplars, yellow birch and ash.

Some plants considered low value to deer are: alder, spruce, hemlock, tamarack, beech, hornbeam, hawthorn, and sycamore.

Some plants that are preferred include: dogwoods, willows, ash, and yellow birch.

From: Ward, Jeffrey S. "Limiting Deer Browse Damage to Landscape Plants," Connecticut Agricultural Experiment Station Bulletin #968, Nov. 2000. Plants resistant to deer browse in a survey of Connecticut gardeners:

Note: Genera on one of the invasive species lists are marked with an asterisk. The invasive species in these genera are prohibited in organic land care.

Annuals and perennials grown as annuals

Genus	Common Name
Cleome	Spiderflower
Catharanthus	Vinca
Tagetes	Marigold
Lobularia	Alyssum
Myosotis*	Forget-me-mot
Senecio	Dusty miller

Groundcovers

Genus	Common Name
Vinca	Myrtle
Ajuga	Bugleweed
Lamium	Dead nettle
Galium	Sweet woodruff
Pachysandra	Pachysandra
Asarum	Wild ginger

Bulbs and Corms

Genus	Common Name
Sempervivum	Hen & chicks
Allium*	Ornamental chives
Ornithogalum*	Star of Bethlehem
Narcissus	Daffodil
Galanthus	Snowdrop

Herbaceous perennials

Genus	Common Name
Convallaria	Lily of the valley
Achillea	Yarrow
Perovskia	Russian sage
Alchemilla	Lady's mantle
Nepeta	Catmint
Aconitum	Monkshood
Stachys	Lamb's ears
Digitalis	Foxglove
Thymus*	Thyme
Solidago	Goldenrod
Podophyllum	Mayapple
Lavandula	Lavender
Mentha	Mint
Artemisia	Silvermound
Papaver	Poppy
Rheum	Rhubarb

Vines

Genus	Common Name
Celastrus*	Bittersweet
Wisteria	Wisteria
Parthenocissus	Virginia creeper

Shrubs and Trees

Genus	Common Name
Leucothoe	Leucothoe
Buddleia	Butterfly bush
Cotoneaster	Cotoneaster
Lonicera*	Honeysuckle
Forsythia	Goldenbells
Chaenomeles	Flowering quince
Deutzia	Deutzia
Calluna	Heather
Buxus	Boxwood
Pieris	Andromeda
Weigela	Weigela
Picea	Spruce
Spiraea	Spirea
Berberis*	Barberry

Organic Land Care Accreditation Form

NAME
ADDRESS
NAME OF LAND CARE BUSINESS

Accreditation will be denied or terminated if the Committee determines that any land care professional practices fraudulent or dishonest reporting in the application, or fails to adhere to the Standards when providing Organic land care services.

ACCREDITATION AGREEMENT
The accreditation program relies on trust in each participating professional's commitment to organic practices, ongoing education in methodology, and our mutual commitment to creating ecologically sound landscapes and living environments for the client.

I, the undersigned do agree to the following:

1. To provide organic services in accordance with the NOFA Organic Land Care Standards to clients who request organic land care services.
2. To abide by good business practices and ethics.
3. To only use the NOFA Organic Land Care logo in connection with organic care as prescribed in the *Standards*.
4. To stop using the NOFA logo and advertising materials if accreditation is not maintained.

.
Signed _____(Land care professional)
Date _____

ORGANIC LAND CARE GUIDE INFORMATION

Name: _____

Name of Land Care Business: _____

Mailing Address: _____
[ ] Check if you do not want your address made public.

Town: _____ County_____

State: _____ Zip + 4 _____

Primary Phone #:_____Second Phone # :_____
[ ] Check if you do not want your 2nd Phone # made public.

E-mail address: _____
[ ] Check if you do not want your email made public.

Web Site: _____

Counties Served
Please list all the COUNTIES that you serve. Please remember to include the states that they are located in. (e.g. Middlesex, CT might be confused with Middlesex, MA)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Professional Qualifications

Include any education, certifications, licenses (please include license number) and professional experience.

_____

_____

_____

_____

_____

_____

_____

Services Provided

Check all that apply.

_____ Design	_____ Landscape Architecture	_____ Restoration
_____ Installation	_____ Plant Health Care	_____ Storm Water Management
_____ Maintenance	_____ Hardscaping	_____ Arborist Services/Tree Care
_____ Consulting	_____ IPM	_____ Pruning
_____ Lawn Care	_____ Mowing	_____ Speaker/Workshop Leader
_____ Compost Tea	_____ Compost/Mulch Application	_____ Compost/Mulch Delivery
_____ Garden Center	_____ Nursery	_____ Greenhouse Management
_____ All Organic	_____ Partially Organic, Partially non-organic	

_____ Specialized Gardens (rock, herb, etc., please specify) _____

_____ Other _____

_____

SOIL TEST RECORD

Attach soil testing results from a recommended professional laboratory.

Tests are recommended every three years.

NAME OF LAND CARE PROFESSIONAL
CLIENT NAME AND ADDRESS

MANURE COMPOSTING RECORD

Compost should start with carbon to nitrogen ratio of 25:1 to 40:1. In-vessel or static aerated pile must be heated to a minimum of 131 degrees and a maximum of 170 degrees for at least three days. If using a windrow system, maintain compost materials at the above temperature range for 15 days, during which time the materials must be turned a minimum of 5 times. Start recording when the pile is created.

NAME OF LAND CARE PROFESSIONAL
LOCATION OF COMPOSTING PILE

DATE	TEMPERATURE	PILE TURNED

ALLOWED PRACTICES RECORD

Records must be kept of the locations, dates and reasons for the following practices:

- Leaving chemically-treated wood (e.g. pressure-treated) on-site because it could not be removed or client did not want it removed. This wood must be coated to prevent further leaching of toxins. (Note that new installation of chemically-treated wood is not allowed.)
- Plastic mulches, including landscape fabric—note that polyvinyl chlorine—PVC—mulches are not allowed.
- Flame weeding. Describe weather conditions at time of treatment.
- Horticultural oil sprays (dormant, suffocating and summer oils) derived from petroleum distillates—note that they must not contain aromatic compounds such as toluene, benzene or xylene. Describe weather conditions at time of treatment.
- Botanical insecticides, such as but not limited to pyrethrum, rotenone, sabadilla, neem, ryania and quassia—note that they must not be formulated with aromatic compounds such as toluene, benzene or xyleneEPA List 1 inert ingredients. Describe weather conditions at time of treatment.
- Insecticides based on plant essential oils, such as clove oil (eugenol), floral extracts (2-phenethyl propionate), thyme oil (thymol), rosemary oil, or wintergreen oil. Describe weather conditions at time of treatment.
- Non-injurious trapping (e.g. Havahart traps) and removal of wildlife (consult state laws about what to do with trapped animals).
- Rodenticides based on vitamin D3. Describe weather conditions at time of treatment.
- Sulfur dioxide smoke bombs for underground rodent control. Describe weather conditions at time of treatment.
- Use of peat moss as a soil conditioner.
- Aerobically composted manure—when finished, must have the characteristics of well-decomposed compost, as defined in Manure section, in order to minimize the risk of survival of pathogens.

LIST OF PROHIBITED PRACTICES AND MATERIALS

This list is provided for quick reference only, for those who are very familiar with the *Standards*. Please refer to the *Standards* in all cases for a complete understanding of prohibited practices and materials.

The following section contains lists of prohibited products (fertilizers, amendments, pest control methods or agents), prohibited practices, and prohibited environmental situations.

NOTE: For indexing purposes, a generic term is inserted sometimes at the beginning of the entry (example would be ***Fertilizers****: Chilean nitrate*). This indexing term should not be misunderstood as a prohibition of all items in that category.

Where a prohibited product category includes all such products, the word "any" is used. Example: *Amendments: **Any** non-approved soil amendments.*

For further details, see the applicable section of the main document.

PROHIBITED PRODUCTS (OTHER THAN PLANTS)

Aluminum sulfate
Amendments: any non-approved soil amendments
Antidesiccants: petrochemical based antidesiccants
Any products that are synthetically-derived
Arsenic
Biosolids
Biosolids or sewage sludge
Burlap that is chemically treated
Calcium that is synthetically-derived
Carbamate insecticides
Chilean nitrate, which has a high nitrate content and similar effect on soil as synthetic nitrogen. This is a place where the olc *standards* differ from the nop (national organic program). Fertilizer approved under nop by omri may contain chilean nitrate.
Compost that has gone anaerobic
Compost with large amounts of weed seed
Compost with undesirable objects or offensive odors
Copper sulfate
Cyanides
Diesel fuel and kerosene-based spray
Diesel products
Fertilizer products containing any prohibited materials
Fertilizers: blended fertilizers using mixture of organic and synthetic materials
Fumigants, all soil fumigants
Fungicides: all synthetic or chemical fungicides
Fungicide-treated seeds
Gas-producing devices as pesticides (Note: sulfur dioxide smoke bombs are permitted)
GMO (genetically modified organism) microbial innoculants
GMO: genetically engineered organisms and their products
Cell fusion, microencapsulation and macroencapsulation, and recombinant dna technology (including gene deletion, gene doubling, introducing a foreign gene, and changing the position of genes when achieved by recombinant dna technology). Such methods do not include the use of traditional breeding, conjugation, fermentation, hybridization, in-vitro fertilization, or tissue culture
GMO: genetically engineered organisms, toxins or plants

Herbicides: all synthetic herbicides, arsenates, and caustic acids or salts
Hydrated or slaked lime
Imidacloprid
Iron chloride
Iron: chelated iron
Leather meal or its by-products
Lime: hydrated or slaked lime
Lime: burned or quick lime (calcium oxide)
Lime: burned or quick lime (magnesium oxide)
Magnesium that is synthetically-derived
Materials: all types of chemically treated wood, burlap, stakes or twine
Materials: anchoring materials containing substances prohibited by these standards (see soil and plant contact materials)
Materials: galvanized steel
Materials: plastic and nonwoven geotextile fabrics that contain polyvinyl chloride (pvc)
Materials: creosote- or tar-treated wood (such as railroad ties)
Micronutrients in toxic quantities
Micronutrients: any synthetic source of micronutrients
Minerals burned or quick lime (magnesium oxide)
Minerals, burned or quick lime (calcium oxide)
Minerals: adding nitrogen, phosphorus or potassium without a soil test
Minerals: aluminum sulfate
Minerals: chilean nitrate, which has a high nitrate content and similar effect on soil as synthetic nitrogen. This is a place where the olc *standards* differ from the nop (national organic program). Fertilizer approved under nop by omri may contain chilean nitrate.
Minerals: hydrated or slaked lime
Minerals: iron chloride
Minerals: muriate of potash (potassium chloride)
Minerals: synthetically derived potassium
Minerals: copper sulfate
Minerals: single and triple super phosphate
Minerals: synthetically-derived calcium
Minerals:: chelated iron
Monoammonium and diammonium phosphate
Mothballs
Mulch: dyed mulch which may contain demolition debris contaminated with lead paint, pressure treated wood or other toxic substances
Mulch: mulch layers exceeding four inches in total depth except when used to smother undesirable or invasive plants
Muriate of potash (potassium chloride)
Newspaper with glossy papers or color inks
Newspaper: colored ink and glossy paper (contain toxic ingredients)
Nitrate: chilean nitrate, which has a high nitrate content and similar effect on soil as synthetic nitrogen. This is a place where the olc *standards* differ from the nop (national organic program). Fertilizer approved under nop by omri may contain chilean nitrate.
Nitrogen that is synthetically-derived, including nitrates, urea, ammonia (e.g. ammonium sulfate)
Organophosphate insecticides
Paper: chemically treated paper and cellulose mulches
Pest control: leghold traps and other traps that cause slow death
Pest control: predator urine (due to inhumane conditions of collection)
Pesticides that are synthetic
Pesticides: all synthetic insecticides, including imidacloprid, pyrethroids, carbamates and

organophosphates and piperonyl butoxide as an insecticide synergist
Pesticides: any pesticide formulated with any inert ingredient on the epa list 1: inert ingredients of toxicological concern.
(see appendix or www.epa.gov/opprd001/inerts/list1chemname.pdf for this list. List 1 inerts are required to be listed on the label.
Pesticides: cyanides, strychnine, phosgene bombs, and other gas-producing devices
Pesticides: poisons, all other long-term poisons, such as arsenic
Pesticides: rodenticides whose active ingredient is warfarin
Pesticides: slug or snail bait with synthetic molluscicides (such as metaldehyde)
Pesticides: nicotine
Petroleum distillates
Phosgene bombs
Phosphate: single and triple super phosphate
Phosphates that are synthetically-derived
Piperonyl butoxide as an insecticide synergist
Poisons – all long term poisons
Polymers: water-retaining polymers
Potassium chloride (muriate of potash)
Potassium that is synthetically derived
Pyrethroids that are synthetic
Rooting agents that are synthetic
Sewage sludge (biosolids), municipal solid waste, paper mill by-products as raw materials of compost.
Sewage sludge: products containing sewage sludge (e.g. milorganite)
Slaked lime
Sludge: anything containing sludge or biosolids
Soil conditioners that are synthetic
Soil conditioning products that are synthetically derived
Soil mix products that are synthetically-derived
Soil tests: home soil test or kit
Species and cultivars of turfgrass with high nutrient and watering requirements
Stakes that are chemically treated
Strychnine
Sulfates that are synthetically derived
Synthetic burlaps
Synthetic fertilizers
Synthetic growth regulators
Synthetic fungicides
Synthetic herbicides (including glyphosates such as Roundup and Rodeo)
Synthetic rooting agents or synthetic wetting agents
Synthetic soil conditioner
Synthetic transpiration repressants
Synthetic wetting agents
Synthetic wetting agents and water-retaining polymers
Synthetically-derived magnesium
Synthetically-derived nitrates, urea, ammonia (e.g. Ammonium sulfate)
Synthetically-derived phosphates
Synthetically-derived potassium
Synthetically-derived products
Synthetically-derived soil conditioning products
Synthetically-derived soil mix products
Synthetically-derived sulfates
Transpiration repressants that are synthetic

Traps: Leghold traps and other traps that cause slow death
Twine that is chemically treated
Warfarin and any products containing warfarin
Weed-barrier fabrics beneath organic mulch (soil and other organic matter will clog the pore system of the fabric and prevent air and water from penetrating into the soil below)
Wetting agents that are synthetic
Wood that is chemically treated
Wound dressings - Petroleum-based wound dressings (tree care)

PRACTICES THAT ARE PROHIBITED

Adding amendments that result in soil and/or plant degradation or environmental damage

Amending the soil with nitrogen, phosphorus or potassium without benefit of proper soil testing

Any methods or materials not approved for organic use

Any practice that results in, or contributes to, the decline of health of desirable plants

Application of more phosphorus than is needed based on soil testing

Application of raw manure in fall/winter without actively growing ground cover

Breaking local, state or federal laws regarding wetlands and buffer zones

Disposal of invasive plant material that could lead to its spread

Disturbing protected areas such as riparian and wetland areas (obey all applicable laws)

Drainage or filling of wetland areas

Dumping off-site in unauthorized areas

Excessive mechanical aeration or rototilling and resultant oxidation of organic matter and soil compaction

Following soil test recommendations for amendments and practices that do not meet these Standards

Installation of edible and/or berrying plants where toxic elemental species are in soil

Irrigation: Excessive irrigation resulting in runoff, compaction and/or disease

Irrigation: Excessive irrigation, which may cause water run-off or puddles, growth of slime mold in lawns, compaction or disease

Irrigation: Excessive irrigation, which can result in runoff, compaction and/or disease

Leaving amendments on the surface unprotected from runoff

Leaving portions of branches during size reduction

Manure: Planting human food crops in sheet composting systems that use animal manure within 120 days before harvest (for other restrictions on use of animal manure, see the Manure section)

Manure: Raw manure applied where human contact is probable, even if soil-incorporated

Manure: Raw manure applied on snow or frozen ground

Mowing less than 2” in height, except for sports turf

Over-application of soil amendments that may cause soil compaction and/or air pollution

Overloading compost which results in exceeding the limits for nitrogen and/or phosphorus (see sections under Fertilizers and Soil Amendments)

Over-watering that may block or reduce aeration of the soil

Planting commercially-propagated rare, endangered, or threatened plant species (to preserve the genetic integrity of wild populations of these plants)

Planting lawn within a wetland or riparian border

Raw manure applied on sandy, fast-draining soils in absence of ground cover

Reminder: Do not burn poison ivy

Removal of contaminated soils for other uses, except for regulated disposal

Removal, harvest, or collection of any rare, endangered or threatened plant (including seeds) from its natural habitat

Removing excessive symplast tissue (tips and buds) from trees and shrubs

Removing grass clippings when persistent herbicides have been applied in the past

Topping

Use of mulch layers exceeding four inches in total depth except when used to smother undesirable or invasive plants

Use of nitrogen, phosphorus or potassium without benefit of proper soil testing

Use of prohibited pesticides, soil fumigants or synthetic fertilizers on any seedling or plant materials

Use of prohibited practices or materials (referenced elsewhere in the Standards) on seedlings or plant materials

Using plants inappropriate to the site, or that require extraordinary inputs and efforts to keep them alive

Using tree gaffs (climbing spikes) while pruning, except for emergency rescue

PLANT MATERIALS THAT ARE PROHIBITED

All plants which are considered to be potentially invasive in Connecticut and Massachusetts (refer to list in the Appendix)

All plants which are known to be invasive in Connecticut and Massachusetts (for specific plants, refer to lists in the Appendix)

Any cultivars or varieties derived from invasive species

Cultivars of turfgrass that are known to be disease- and/or insect-prone

Endophytically-enhanced grasses where the grass may be grazed

Fungicide-treated seed

Genetically modified organisms (e.g. Roundup-Ready grass seed)

Genetically modified seed for living mulches

Genetically-modified seeds and plants

Installation of edible and/or berrying plants into soils contaminated with toxic elemental species

Monoculture stands of a single species of turfgrass

Plant choice: Inappropriate plant choice—plants that are not suited to site conditions

Planting commercially-propagated rare, endangered, or threatened plant species (to preserve the genetic integrity of wild populations of these plants)

Using Landscape weed barrier fabrics beneath organic mulch (soil and other organic matter will clog the pore system of the fabric and prevent air and water from penetrating into the soil below)

Using plants inappropriate to the site, or that require extraordinary inputs and efforts to keep them alive

ENVIRONMENTAL CONDITIONS THAT ARE PROHIBITED

Leaching of nutrients and/or soil amendments through runoff

Runoff from disturbed sites onto other areas

Surface water causing flooding or erosion problems

US EPA - Office of Pesticide Programs List of Inert Pesticide Ingredients

LIST 1. Inerts of Toxicological Concern

CAS No.	Chemical Name
62-53-3	Aniline
1332-21-4	Asbestos fiber
71-43-2	Benzene
1332-21-9	1,4-Benzenediol
3068-88-0	B-Butyrolacetone
7440-43-0	Cadmium compounds
75-15-0	Carbon disulfide
56-23-5	Carbon tetrachloride
108-90-7	Chlorobenzene
67-66-3	Chloroform
62-73-7	DDVP
106-46-7	p-Dichlorobenzene
117-87-7	Di-ethylhexylphthalate (DEHP)
54-14-7	1,1-Dimethyl hydrazine
540-73-8	1,2-Dimethyl hydrazine
534-52-1	Dinitro-o-cresol
51-26-5	Dinitrophenol
123-91-1	Dioxane
106-89-8	Epichlorohydrin
110-80-5	Ethanol, 2-ethoxy (cellulosive)
111-15-9	Ethanol ethoxy acetate
96-45-7	Ethylene thiourea
107-06-2	Ethylene dichloride
109-86-4	Ethylene glycol monomethyl ether; methyl cellulosive
140-88-5	Ethyl acrylate
77-83-8	Ethyl methyl glycidate
50-00-0	Formaldehyde
70-30-4	Hexachlorophene
110-54-3	n-Hexane
302-01-2	Hydrazine
78-59-1	lsophorone
7439-92-1	Lead Compounds
568-64-2	Malachite Green
1191-80-6	Mercury oleate
591-78-6	Methyl n-butyl ketone
74-87-3	Methyl chloride
75-09-2	Methylene chloride
79-46-9	2-Nitropropane
25154-52-3	Nonylphenol
30525-89-4	Paraformaldehyde
87-86-5	Pentachlorophenol
127-18-4	Perlcoroethylene (PERC)
108-95-2	Phenol
90-43-7	o-Phenylphenol
78-87-5	Propylene dichloride (1,2-dichloropropane)
75-56-9	Propylene oxide
8003-34-5	Pyrethrins and pyrethroids
81-88-9	Rhodamine B
10588-01-9	Sodium dichromate
131-52-2	Sodium pentacholorohenate
62-56-6	Thiourea
26471-62-5	Toluene diisocyanate
79-00-5	1,1,2-Trichloroethane
56-35-9	Tributyl tin oxide
79-01-6	Trichloroethylene
1330-78-5	Tri-orthocresylphosphate (TOCP)
78-30-8	Tri-orthocresylphosphate (TOCP)